INDIANAPOLIS FEB 5 1900 PUBLIC LIBRARY

AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

VOLUME 23 NEW YORK, THURSDAY, FEBRUARY 1, 1900 NUMBER 5

Published at 218 William St., New York,
Every Thursday by the

American Machinist Press.

[INCORPORATED.]

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Correspondence on mechanical subjects solicited. Name and address must always be given—not necessarily for publication.

Address all business communications to the American Machinist Press. Matter for reading columns may be addressed to the Editor.

Subscribers can have address changed at will. Give old and new addresses. Date on wrapper denotes end of month in which subscription expires.

Subscription Price:

$3 per year in advance, postage paid, in North America.
$4 per year in foreign countries, postage prepaid.
No back numbers beyond current year.
For sale by newsdealers, generally.

CHAS. CHURCHILL & CO.,
9 to 15 Leonard St., Finsbury, London,
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Entered at New York P. O. as second-class mail matter.

Cable address, "MACHINIST," N. Y.
Lieber's and A B C Codes.

The Disappearance of Hand Work.

The description and discussion of the ways and means of machine work come never amiss to our readers. On another page of our present issue a correspondent tells us of his extraordinary arrangements for machining some surfaces of a sluice gate so large as not to come within the legitimate scope of his machine tools. The job is one of those which are of practical interest to many of our readers, and which are apt to provoke them to suggest other ways of doing them with the usual facilities of the average shop. There are doubtless several other and quite different ways in which the required surfaces could have been machined, but we need not here attempt to suggest them. The thing most calling for remark in connection with the job is that no one suggested or apparently thought of doing the job by the old-fashioned method of chipping and filing. There appears to have been but a single sluice gate to build in this case. It would not be difficult, we think, to prove that the actual work under consideration could have been done as cheaply and as satisfactorily by hammer and chisel and file in hands with the old-time skill, when the time required in pulling apart the tools and setting them and restoring them to their former place and condition is counted. The great transformation which the machine trade has undergone is here indicated. Hand work for extensive or protracted operations in the shop has dropped out of the minds of designers, of superintendents and of foremen. And yet at a time easily "within the memory of men still living," and even within the memory of men still active in the shops, machine work would not have been thought of for the actual job described by our correspondent, and hand work would have been considered the only and the very proper and satisfactory means for its execution. We think of and adopt the means that we have, and the old chipper and filer is not among them. "Not for this faint we, nor mourn nor murmur; other gifts have followed for such loss we would believe abundant recompense," as Wordsworth said when thinking along vastly different lines. Machine work, upon the whole, is vastly cheaper and vastly more accurate and reliable than the hand work that it has displaced. There was not long ago, if there is not now, one little place about the main bearing of the "straight-line" engine which it was the practice of the shop to chip and file, and the mechanical critics were inquiring why this little bit of surface was not milled or planed, as it naturally should have been, instead of being done in the old-fashioned way, and Prof. Sweet has been in the habit of confessing that the old practice was retained to give the boys the one solitary lesson of the shop in the obsolete art of chipping and filing. It is easy to sympathize with the sentiment exhibited, just as we stop in the zoo before the solitary buffaloes that we are trying to keep alive, but time sweeps clean at last.

Technical Publications.

"Indicator Diagrams." By W. W. F. Pullen. 238 5½x8½-inch pages, with 261 illustrations. The Scientific Publishing Company, Manchester, England. Price six shillings.

This book covers some ground which is not usually embraced in similar publications. Thus the subject of calibrating indicator springs, including several forms of apparatus employed for that purpose, is quite fully discussed, as well as various sources of error in the diagram. More than the usual amount of attention is given to applications of the indicator to other places than steam-engine cylinders, and numerous diagrams are given from gas and gasoline engines, and from air, feed, circulating and other pumps. To American readers, perhaps the most interesting chapters are those which describe recent novel forms of indicators made in England. Some of these are of undoubted merit and deserve to be known here better than they are.

"Handbook of Testing Materials." By Adolf Martens. Authorized translation by Gus. C. Henning. In two volumes. Volume 1, Text; 622 6x9-inch pages. Volume 2, Illustrations; 240 6x9-inch pages, with 514 figures, 51 full-page and 11 folding plates. John Wiley & Sons, New York. Price $7.50.

The man who imagines the testing of materials to consist of the application of a load and the reading of a scale-beam, should see this book. We have some acquaintance with the aims and methods of the modern investigator in this field, but nevertheless this book is a revelation to us. It is impossible in a notice like this to give any adequate idea of its contents, and perhaps the best way of indicating its general character is to say that it bears on every page the stamp of that characteristic thoroughness which we have come to associate with German technical work. The translator is well known to be imbued with this same spirit. Had it been otherwise, he would not have attempted so great a task as was involved in making the translation. We cannot attempt an extended review, and it must suffice to say that no one who wishes to be well informed regarding the most advanced theory and practice of testing structural materials can think of being without this work.

"Steam Engine Theory and Practice." By Wm. Ripper. 398 5½x8½-inch pages, with 434 illustrations. Longmans, Green & Co., London and New York. Price $2.50.

The most useful portions of this book to American engineers are those which give the applications of thermodynamic analysis to actual engine conditions. Capt. Sankey's temperature entropy chart, which was originally published as a separate sheet, is incorporated as an inset plate,

and is the basis of these applications. The first chapter gives the essentials of the thermodynamics of gases, and this is followed by chapters on the properties of steam and on temperature entropy diagrams, the method of transferring indicator diagrams to the temperature entropy chart following in due course.

It is well known that greater attention is paid to this form of analysis of steam engine performance by English than by American engineers, and this book gives the methods followed in England more clearly and concisely than we have seen elsewhere. It is not seriously mathematical, not much mathematical work beyond common algebra appearing, and no alarming amount of that. Such as does appear, is, however, essential to the reading of those portions of the book with profit, and it should not be attempted by those who are unable or unwilling to follow it through.

The Molders' Wage Scale.

At the joint conference of the Scale Committees of the National Founders' Association and of the Iron Molders' Union of America, held at Indianapolis, January 22, the scale of wages was agreed upon for the period from April 1 next to January 1, 1901. The agreement is to extend also through the year 1901, unless during December of this year notice to the contrary is filed by either side. The wage scale agreed upon is an advance of 25 cents all around, floormen getting $2.50 a day and bench molders $2.75, and time and one-half for all overtime.

We have received from the Columbus Machine Company, Columbus, Ohio, photograph of a gear wheel of somewhat unusually large dimensions, which they have recently cast and machined for one of the large plate mills of the Chester Rolling Mill Company. The photograph shows this wheel on a boring mill. It has a pitch diameter of 17 feet 6 inches. The teeth are of the double helical or herring-bone form, 30 inches face to the wheel, with a shrouding of 2½ inches on each side. The wheel is bored to fit a 23-inch shaft, and weighs about 80,000 pounds. It was cast in one piece, and afterwards split for transportation and erection. The pinion with which this wheel is to operate has a diameter of 7 feet, is bored for a shaft 19 inches in diameter, and weighs 24,000 pounds.

Personal.

Robt. J. Good, who was formerly chief draftsman for the Stiles & Parker Press Company, and was later with the E. W. Bliss Company, is now chief draftsman for the Toledo (Ohio) Machine & Tool Company.

Fr. Kuhlmann, who for nine years past has been with the Deering Harvester Company, of Chicago, has accepted a position as general foreman with Rudolphi & Krummel Machine Works, of the same city.

H. M. Lucas, who has been draftsman for Warner & Swasey for fourteen years, the last nine years as chief draftsman, has resigned that position and organized the Lucas Machine Tool Company, of Cleveland.

Obituary.

Robert Karnaga, one of the oldest locomotive engineers of the Pennsylvania Railroad, died in Philadelphia January 23, fifty-six years old. He entered the company's employ at the age of fifteen and retired last year, after forty-one years of continuous service.

Marcena Hitchcock died at Hartford, Conn., January 18, sixty-seven years old. Mr. Hitchcock was born near Utica, N. Y., and early became an expert machinist, especially in small work. During the civil war he was with the Remington Arms Company at Ilion, N. Y., and later with the Sharps Pistol Company in Philadelphia. He went to Hartford in 1865, and, with others, began the manufacture of the Weed sewing machine, on the top floor of what is now the main building of the Pratt & Whitney Company, removing later to what is now the main building of the Pope Manufacturing Company, and here Mr. Hitchcock, in 1878, built for the Pope Company the first bicycles, high pattern, that were made in this country. In 1886 the Hitchcock & Curtiss Knitting Company was formed, and with this company the remainder of his active life was spent, several valuable improvements in knitting machines marking this period. A daughter of Mr. Hitchcock is the wife of Mr. H. F. L. Orcutt, of Ludwig Loewe & Co.

Inquiry for Machinery.

(120) Names of firms who build machines to straighten bar iron as it comes from rolling mills. Iron to be straightened ranges in size from 1¼x1¼ inches to 4x ½ inch, and must be straightened while cold.

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(1) G. T. C., St. Louis, asks: An indicator diagram from a non-condensing steam engine shows an initial pressure of 70 pounds gage; the steam is compressed in the clearance space to 35 pounds gage; what proportion of the steam required to fill the clearance to the initial pressure of 70 pounds is furnished by the compression? A.—Referring to Kent, we find that the weight of 1 cubic foot of saturated steam at 70.3 pounds gage is .1971 pound, while the weight for the same volume at 35.3 pounds is .1198. Then .1198 ÷ .1971 = .6078, or, say, compression supplies .6 of the steam required to fill the clearance.

(2) W. L., Davenport, Iowa, writes: I have an engine pulley 108 inches diameter, belted to a 28-inch pulley on a countershaft, and a 24-inch pulley on the same shaft belted to 48-inch pulley on the line shaft. The speed of the countershaft is, therefore, $108 : 75 :: 28 : x = 289.26$ revolutions per minute, and the speed of the line shaft is $289.26 : 24 :: 48 : x = 144.63$. Now, the engine belt slips on the 28-inch pulley, and to remedy this I thought to use larger pulleys, but of such diameters that the speed of the line shaft would not be changed. In place of the 28-inch pulley, I intend to use a 48-inch, and instead of the 24-inch a 41-inch pulley. The speed of the countershaft will then be $108 : 75 :: 48 : x = 168.75$, and the speed of the line shaft will be $168.75 : 41 :: 48 : x = 144.14$. This is .49 less than in the first case, but is near enough. Am I correct, and will the change cure the trouble with the belt? A.—The computations are correct, and as the pull upon the first belt will be reduced in the ratio 48 : 28, or nearly one-half, for the same power transmitted, there should be no more trouble with the belt. We usually compute the speed in a single operation, no matter how many countershafts may be employed. Thus: $(75 \times 108 \times 41) \div (48 \times 48) = 144.14$. Here the speed of the driver multiplied by the diameters of both—all—the driving pulleys, and divided by the product of the driven pulleys, gives the speed of the driven shaft.

The National Association of Manufacturers has issued a pamphlet entitled "Commercial Traveling in South America," which pamphlet is written by Wm. E. Torrens, who made a business trip to South America recently and traveled extensively for the purpose of making investigations into the commercial conditions and methods of doing business there. This pamphlet o ght to be, and probably will be, of special interest to those who may have business in South America, or who may desire such business.

It is said that tauric acid, a new chemical discovery, obtained from tauric moss—a lichen or fungus, usually found growing upon rocks and the roots of trees throughout the country—has been found to possess properties which will render it invaluable as a solvent of metals. Gold, silver, steel, aluminum and lead, when immersed in the acid, become pliable and ductile as putty. The advantages it presents for workers in metal—more especially jewelers—are readily apparent. Designs can be molded by the hands alone, without the use or assistance of heat. Strange to say, however, the acid has no effect upon iron.

Commercial Review.

NEW YORK, MONDAY EVENING,
January 29, 1900.

WOOD-WORKING MACHINERY.

Readers of the "American Machinist" for the last two or three years will remember the accounts published from time to time of the rise and progress of the wood-working machinery "trust." That organization, when projected, was expected to take in almost the entire wood-working machinery manufacturing property of the country under the virtual leadership of the J. A. Fay & Egan Company. When, after years of negotiation, it materialized as the American Wood-working Machinery Company, it included only about a dozen concerns, among which the Fay-Egan company did not figure at all, nor did most of the stronger manufacturers. The new "trust" did not have the influence in the market that was anticipated, and after a brief period of untrammeled existence it has been carrying on business in the hands of a receiver.

The unsatisfactory results of this first attempt at combination among wood-working machinery manufacturers lends a peculiar interest to a new and different sort of an association, into which ten existing manufacturers, including the American Wood-working Machinery Company itself, have entered. The number includes the J. A. Fay & Egan Company, Berlin Machine Works, H. B. Smith Machine Company, S. A. Woods Machine Company, Hall & Brown, of St. Louis, the Defiance Machine Works and others. The strength of this personnel is apparent. Representatives of these concerns met in New York the last week in December and organized an informal and nameless association, which is to hold monthly meetings to discuss and arrange for mutual benefit in matters of trade. Mr. Thomas Egan was chosen president. An arrangement was effected to adjust prices. At least one company made an advance of about 10 per cent.

At the same meeting the topic of export trade came under discussion, and the sentiment was to encourage, as far as possible, dealings directly with the foreign buyer rather than through commission houses.

It is said to be the intention not to try the trust experiment over again, but to preserve this association as an informal one. The second meeting convened in Chicago, January 24, and a correspondent of a daily newspaper wires the statement that combination was then discussed.

MACHINE TOOL NOTES.

The statements of such machine tool men as have been talked with this week indicate that prices are holding pretty steady, judging from the attitude of their various correspondents.

A manufacturer of upright drills of not particularly large size is declining to take orders on less than five or six months' time for delivery. This denotes an unusual pressure of orders.

Lucien Marechal, chief engineer of the rolling stock of the Paris-Lyons-Mediterranean Railway, with his secretary and A. Paris, superintendent of the Arles shops of the road, have been spending ten weeks in this country, studying American methods and the construction of rolling stock. This railroad is in the market for 6,000 freight cars, and the American Car and Foundry Company is said to have submitted a proposal for them. Of more interest to machinery manufacturers, however, is the statement that a decision is being arrived at to equip the locomotive shops at Paris and Lyons and the car works at Arles and Nimes with American labor-saving machines. These equipments, as proposed, are estimated at $300,000 in value, and it is the intention to contract for them through the Paris firms who represent American manufacturers.

ELECTRICAL NOTES.

The General Electric Company continues to book a heavy volume of street railway equipment orders. Several 1,500-kilowatt rotary transformers are under contract for the Metropolitan Street Railway Company, New York. The Minneapolis Railroad has just ordered eighty car equipments and a new water-power electric plant to duplicate the old one.

The Eddy Electric Manufacturing Company booked an increase of orders in 1899 as compared with 1898 amounting to some 70 per cent.

The C & C Electric Company makes a most favorable report of the new year's trade. For the last two weeks it has been fairly swamped with orders. Some large ones have been for export. The foreign field has been lucrative of late, in all directions, orders having come from Europe, Spanish America and the Far East. Last year's business, the heaviest on record, was about 25 per cent. in excess of that of 1898. Deliveries now range from one week up to four or five months; prices are pronounced strong, and materials hard to obtain.

MISCELLANEOUS.

The Nicholson File Company, Providence, R. I., which for several weeks past has been negotiating for the purchase of the Eagle File Company, Middletown, N. Y., completed the transaction January 18, and circulars announcing the fact have been issued. The Nicholson File Company acquires the real estate, plant, machinery, good will and stock of goods of the Eagle Company, and will continue the manufacture of the Eagle brand of files. It assumes the unfilled orders of the Eagle Company, and accounts due are payable to it. Accounts against the Eagle Company will be paid by the Nicholson Company, if contracted since December 31, 1899, otherwise by F. M. Madden, Middletown, N. Y. The total daily production of the various factories owned by the Nicholson Company is thus brought up to practically 7,000 dozen files and rasps per day.

An export commission merchant, in conversation yesterday, brought up the subject of pneumatic tools abroad. It is his experience, as it has been of others, that this line of tool is becoming specifically popular in Europe.

The Chicago Pneumatic Tool Company has purchased five acres of ground at Germantown, Philadelphia, upon which are several buildings, the main one being of steel, 330 feet long by 120 feet wide. The present works of the National Pneumatic Tool Company and the Whitelaw Works, which have recently passed under the control of the Chicago Pneumatic Tool Company, will be removed to this new location. The line of manufacture will be developed to cover the entire range of pneumatic tools and apparatus.

The New York Air Compressor Company reports sales of over ten air compressors in as many days. These include a large duplex compressor for Japan and four compressors of 1,200 cubic feet capacity for the Pennsylvania Railroad.

The H. B. Smith Machine Company finds the wood-working machinery trade excellent. The factory is at present behindhand with orders, but the company lately made remarkably quick work in filling an order for the United States Government. This was for a planing, door, sash and blind mill at Manila, to be used in turning out material for a new 100-ton ice-plant, barracks and other Government construction work. An oral order for the machines was received the last Saturday in December, and by January 10 the machinery was on board ship, although the company's stocks in various places were drawn upon ruthlessly in order to accomplish it. There were seventy-two cases, containing thirty-one machines. This is said to be the first wood-working machinery that has ever gone from the United States to Manila.

Automobile manufacturing companies continue to be hatched out at an astounding rate. Inasmuch as these concerns are apt to need equipment we have compiled a list of a considerable number which have been incorporated within about a month past: Stuart Power and Motor Company, Jersey City, capital $100,000; Hewitt Lindstrom Motor Company, Chicago, capital $30,000; Mexican Electric Vehicle Company, Jersey City, capital $500,000; International Automobile Construction Company, Portland, Me., capital $100,000; Shaw Motor Vehicle Company, Portland, Me., capital $5,000,000; Western Automobile Company, capital $6,000,000, principal office, New Jersey Corporation Guarantee and Trust Company, Jersey City; Rotary Motor Vehicle Company, Kittery, Me., capital $400,000.

The American Electric Vehicle Company, chartered in Illinois, has been rein-

corporated in New Jersey. The capital stock is $5,000,000. Its main office has been removed from Chicago to New York. J. H. Ballentine is president. There has also lately been incorporated a concern called the American Vehicle Company, New York city, capital $1,000,000, to use and apply air as motive power for operating vehicles and engines. The Automobile Company of America is fitting up a large plant at Marion, N. J. George O. Dumpey & Bro., manufacturers of horseless carriages in Boston, are arranging for the erection of a $15,000 factory in Seattle, Wash. Some capitalists contemplate the establishment of a $100,000 plant at Indianapolis.

Among some views on export trade derived from an interview with a spokesman for Henry W. Peabody & Co., published in a recent number of this paper, reference was made to a rumor that one of the prominent Continental firms dealing in American tools had stocked so heavily that it would be left in a very uncomfortable position if the market changed for the worse. Since certain firms who have read this statement are afraid that their interests may be prejudiced thereby, it may be well to explain that what was meant was that if prices fell there would be many tools to dispose of at a sacrifice of profit, possibly a loss; but no insinuation was intentionally given, nor belief cherished, that the financial credit of the firm would be impaired, even if prices should decline as apprehended. This the spokesman admitted in answer to a question at the time of the interview. Our paraphrase of the conversation may have been susceptible of misinterpretation.

PITTSBURGH REPORT.

The general iron and steel trade has shown but little change since the first of the year, as the market is pretty well covered for some few months to come with orders placed some time ago. Small lots are changing hands daily, but even the aggregate is relatively small. Requirements for almost three-fourths of the year have been filled at high prices, and that, of course, confines all sales to small lots. The real rush for new business has not made an appearance, but there is a movement on foot which will soon develop. The present is the transition period of the old business which was forced to delay from 1899.

In finished lines manufacturers are in better shape to look after new business, as the mills have been able to make shipment of old orders which were "hung up" for the past six months or so. Especially is this true of plates. There is to be plenty of shipbuilding and other work which ought to consume plates. As yet there has not been any quick movement to buy plate, which is but natural, as there are some "left over" orders still to be finished.

All the foundries in this locality are working up to capacity. The Westinghouse Machine Company has leased the old foundry plant formerly operated by the Robinson-Rea Manufacturing Company, and will thus be in better shape to make castings. The company's plant at East Pittsburgh was found inadequate to take care of all the orders, and until the works are enlarged the newly-acquired plant will serve very well. The Duquesne Steel Foundry Company has awarded several more contracts for the erection of its new plant at Coraopolis, near Pittsburgh, and expects to have the plant in operation by the middle of summer.

The Union Steel Company has decided upon a location for its plant, but refuses to make the place known. The contracts for the engines, boilers, rolling mills, etc., have been placed. Messrs. James Bonar & Co., of this city, secured a contract this week for 5,000 horse-power feed-water heaters of the Pittsburgh type.

CHICAGO MACHINERY MARKET.

Scarcity of one kind of material, where many are used, will silence an entire plant. A few experiences of that nature are heard of. There have recently been fitted up quite a number of electroplating departments by large manufacturers and of independent shops by small producers. Many of these are now waiting for a supply of anodes, which they had expected to obtain by return express upon ordering them, but which they now find will not arrive for perhaps two months. The exhaustion of nickel stocks and the limited production of that metal are the causes. Cyanide of potash, now supplied by German manufacturers almost exclusively, on account of its cheap production in Germany as a by-product of coke manufacture, is also very scarce and rapidly advancing in value. Though the South African war has greatly restricted the demand from that continent, the unusual mining developments elsewhere have obliterated stocks. Buffs, also, are a rare commodity in the machinists' supply line, and the necessary grades of cotton for their manufacture are not obtainable in sufficient quantities for current needs. Articles of steel or copper composition are generally equal to demand.

Belting manufacturers are reporting the best selling records in history. The new list, advancing the prices of narrow sizes and slightly reducing the cost of the wide sizes—called an "equitable" list—while on the average increasing the cost of belting considerably, does not seem to have unfavorably affected trade. The relative proportions of wide and narrow belting sold seem to be practically unchanged, the natural increase in the number of large manufactories using belts being neutralized by the abandonment of belts by some large electrical plants for directly connected power. Emery wheel makers are well filled with orders for several months ahead or longer, and do not appear willing to contract with consumers for long periods in the future, as they did a year ago.

Trade in machinists' supplies generally is very good. January will perhaps in the aggregate not quite equal the business of December, but the latter month, with many makers and sellers, was the best in their history. The dominant tone of the market is one of satisfaction with present trade and confidence in its indefinite, unshrinking continuance.

The Reeves Pulley Company has for several months been eclipsing any sales records in its history. The Chicago Belting Company is doing the best trade since it started in business. C. H. Besly & Co. report a thriving trade, with every indication that it will continue. The Sterling Emery Wheel Company has been running overtime, but it is not able to gain upon its accumulated orders. The Hanson & Van Winkle Company is unable to accept all the business that is offered the company.

Quotations.

NEW YORK, Monday, Jan 29, 1900.

Iron—American Pig, tidewater delivery:—

Pennsylvania Irons:	
No. 1 X foundry	$24 20 @ $24 70
No. 2 X foundry	23 20 @ 23 70
No. 2 plain	22 20 @ 22 70
Alabama Irons:	
No. 1 foundry	22 50 @ 23 00
No. 2 foundry	21 50 @ 22 00
No. 3 foundry	20 50 @ 21 25
No. 1 soft	22 50 @ 23 00
No. 2 soft	21 50 @ 22 00
Foundry forge	20 00 @ 20 75

The iron market is disappointingly quiet. Crucible steel sheets have been advanced ½c. per pound. Certain large manufacturers of steel plates for boilers, etc., are at war and are cutting prices on same.

Bar Iron — Base sizes — Refined, mill price on dock, 2.10 @ 2.25c.; store price, 2.50 @ 2.60c.; common from store, 2.45 @ 2.50c.

Tool Steel—Base sizes—Standard quality, 7 @ 8c.; extra grades, 12 @ 14c.; special grades, 16c. and upward.

Machinery Steel—Base sizes—Ordinary brands from store, 2.85 @ 3c.

Cold Rolled Steel Shafting—Base sizes—From store, 4 @ 4¼c.

Copper—Lake Superior ingot, 16½c @ 16⅝c.; electrolytic, 16 @ 16¼c.; casting copper, 15⅞ @ 16⅛c.

Pig Lead—Wholesale lots, 4.70c., New York delivery; carloads, 4.72½ @ 4.75c.

Pig Tin—In 5 and 10-ton lots, f. o. b., New York, 28c.

Spelter—Prime Western, 4.80 @ 4.85, New York delivery.

Antimony—Cookson's, 11c.; Hallett's 9¾c.

Lard Oil—Prime City, present make, 51 @ 53c. in jobbing lots.

The Walker & Pratt Foundry at Watertown, Mass.

Iron foundries, the same as machine shops or other industrial establishments, have their special lines of work, their limiting and determining conditions of location, of design and arrangement and of management, their individuality. A highly successful, a typical, a model establishment in one location and for a certain line of work, might have many features which would be undesirable, if not impossible, for different work with different men in a different location. Nevertheless, it rarely happens that each may not learn many things from the other, which is not only a full warrant for our presentation of the establishment here shown, but bespeaks in advance the interest of our readers whose lines may not be identical with those here indicated.

The Walker & Pratt foundry is a new installation of an old established and long successful business. It would be classed as a stove foundry, but is more properly a complete manufactory of stoves and of hot-air and hot-water furnaces of the highest grade, its business being very largely confined to New England and the other Eastern States. Its product very distinctly does not compete with the cheaper lines of similar goods in the national or foreign market.

Watertown is an easily accessible suburb of Boston, and the employees of the establishment may be assumed to be more or less in touch with the city, and availing themselves of the advantages of contiguity, so that they may not be of precisely the same class as would be found in, for instance, a small and isolated town far in the interior. To go to the foundry you may start at the upper corner of Boston Common, where there is a long flight of stone steps leading down to the subway of the "Elevated" railway. You buy a five-cent ticket and wait on the platform for a minute or two, seeing the cars of the different lines following each other in close procession, each waiting long enough for its passengers to get on (there is no getting off at this platform), and then the Watertown car comes along. You follow a tortuous course through the clean, airy and comfortably lighted subway for a minute or two and then come to the surface at the diagonally opposite corner of the Common, following Boylston street for some distance, then over the Charles river and through Cambridge, passing the building of Harvard University, and then Mount

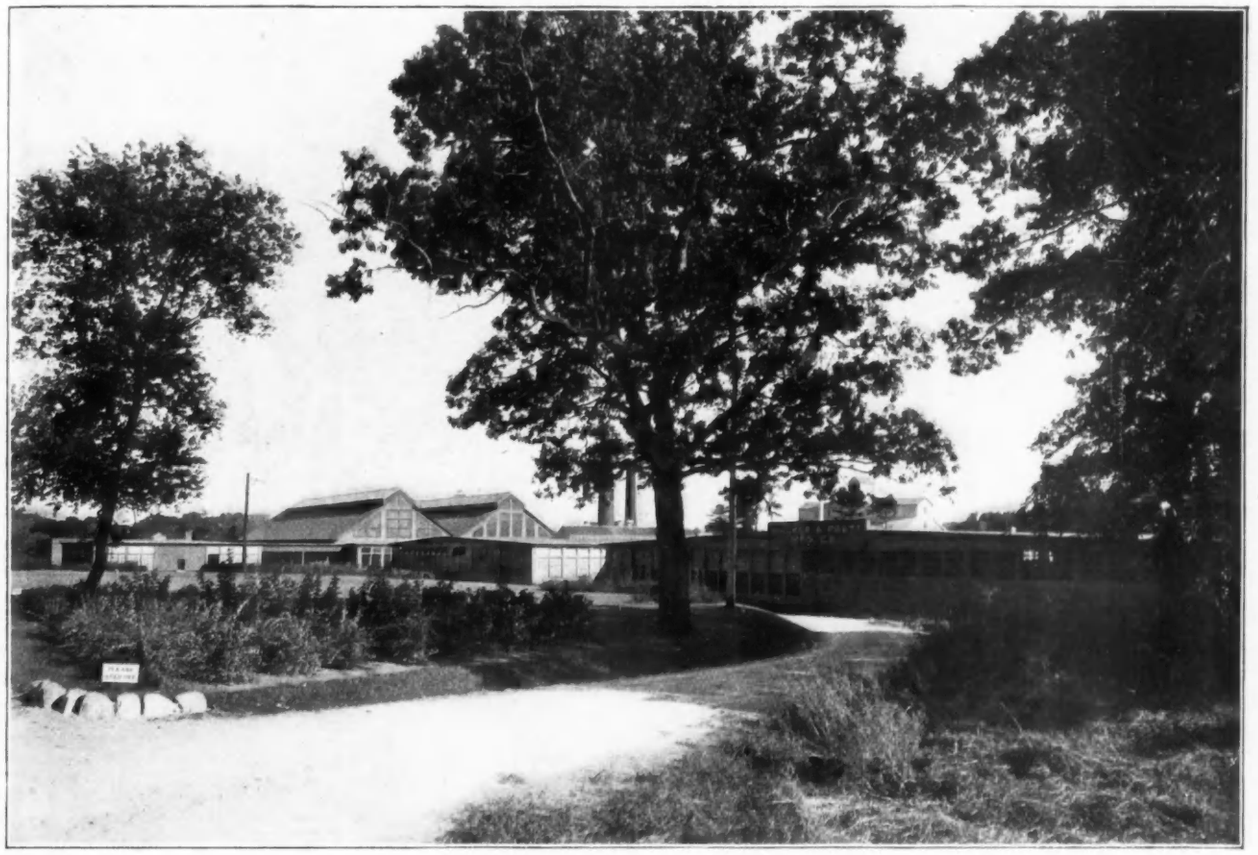


FIG. 1. FRONT OF THE WALKER & PRATT ESTABLISHMENT.

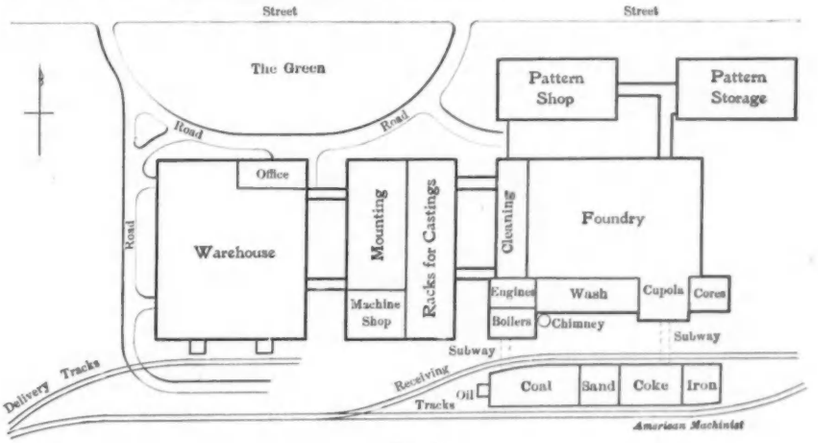


Fig. 2

PLAN OF BUILDINGS AND GROUNDS.

Auburn Cemetery, and when your conscience begins to remonstrate against riding so far for a nickel, you ask the conductor for the Walker & Pratt foundry, as also are the grounds on the other sides. The entrance to the office is behind the trunk of the principal tree in the picture, that corner of the building being used for various buildings. A large portion of the land to the east, with the flask storage sheds, the dumping ground for refuse and a pond for water storage are not shown. The first determining condition in choice of location was of course the securing of good railroad facilities, and the southern line of the land therefore lies along a branch of the Fitchburg Railroad, with a side track running into the yard alongside of the shipping department and on both sides of the iron, coal and sand storage building. The general level of the land is as correct for the service as could be found in the prairie States, while the easterly end is low enough to provide a dumping ground for years to come. The railroad frontage is about a third of a mile. The liberal foresight that secured so large a tract where the land values run so high, and must run so much higher, is worthy of remark. The grounds of the United States arsenal at Watertown, by the way, lie across the road along the other side of the same railroad. Much adjoining property is controlled by members of the company, and houses are already erected for

FIG. 3. HOUSES OF EMPLOYEES.

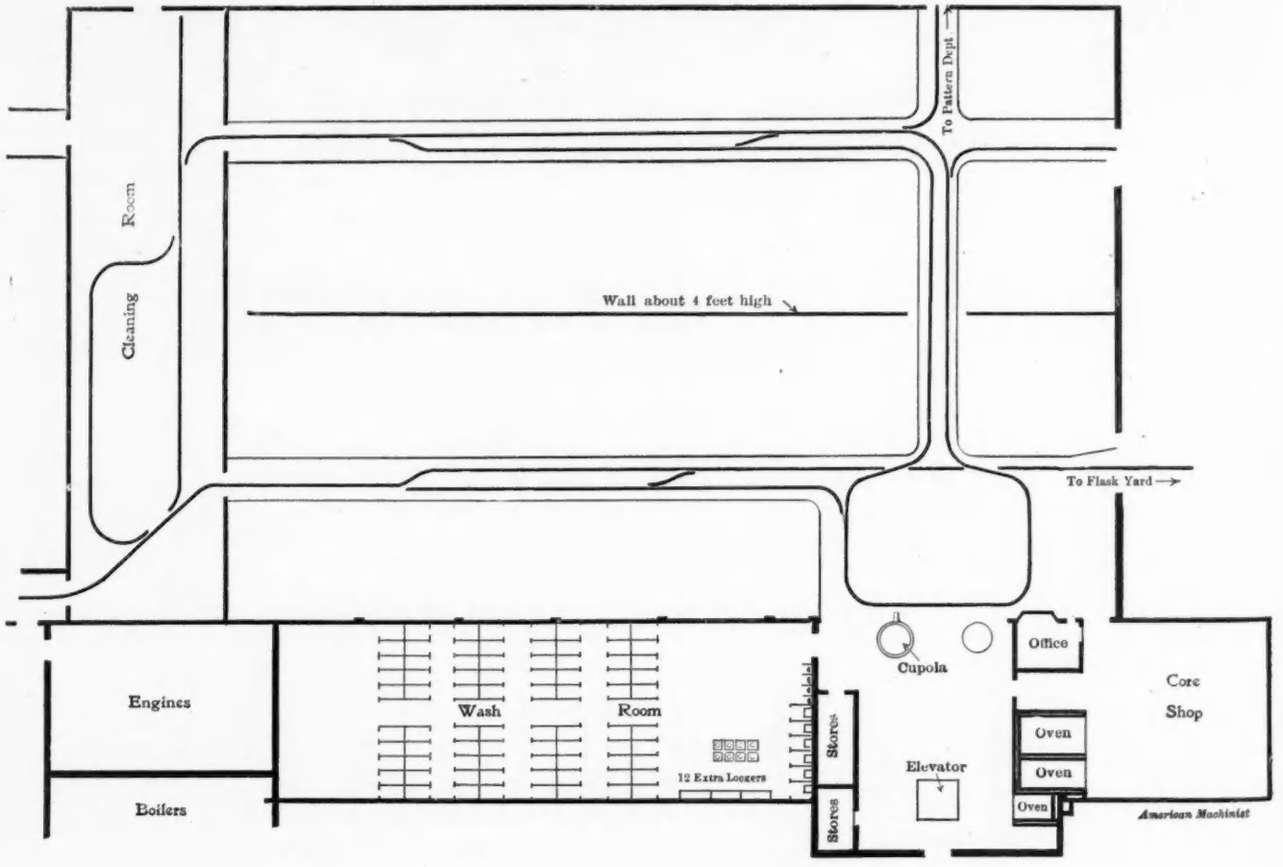


Fig. 4

PLAN OF FOUNDRY, SHOWING OVERHEAD TRUCKS.

and he tells you it lies off there to the left about a quarter of a mile.

Fig. 1 is a good general view of the plant as you approach it, all of the land in the foreground belonging to it and being constantly kept in the condition shown, the office, while the front to the right of the tree is the showroom, in which are exhibited samples of the elaborate and beautiful stoves and furnaces produced.

Fig. 2 is a plan of the grounds with the location and relative dimensions of the the occupancy of the employees; these are conveniently arranged and have the usual modern city conveniences. Those shown in Fig. 3 are directly across the street from the office front. These, except the first, are double, or comprise two com-

FIG. 5. DELIVERING THE IRON FROM THE CUPOLA.

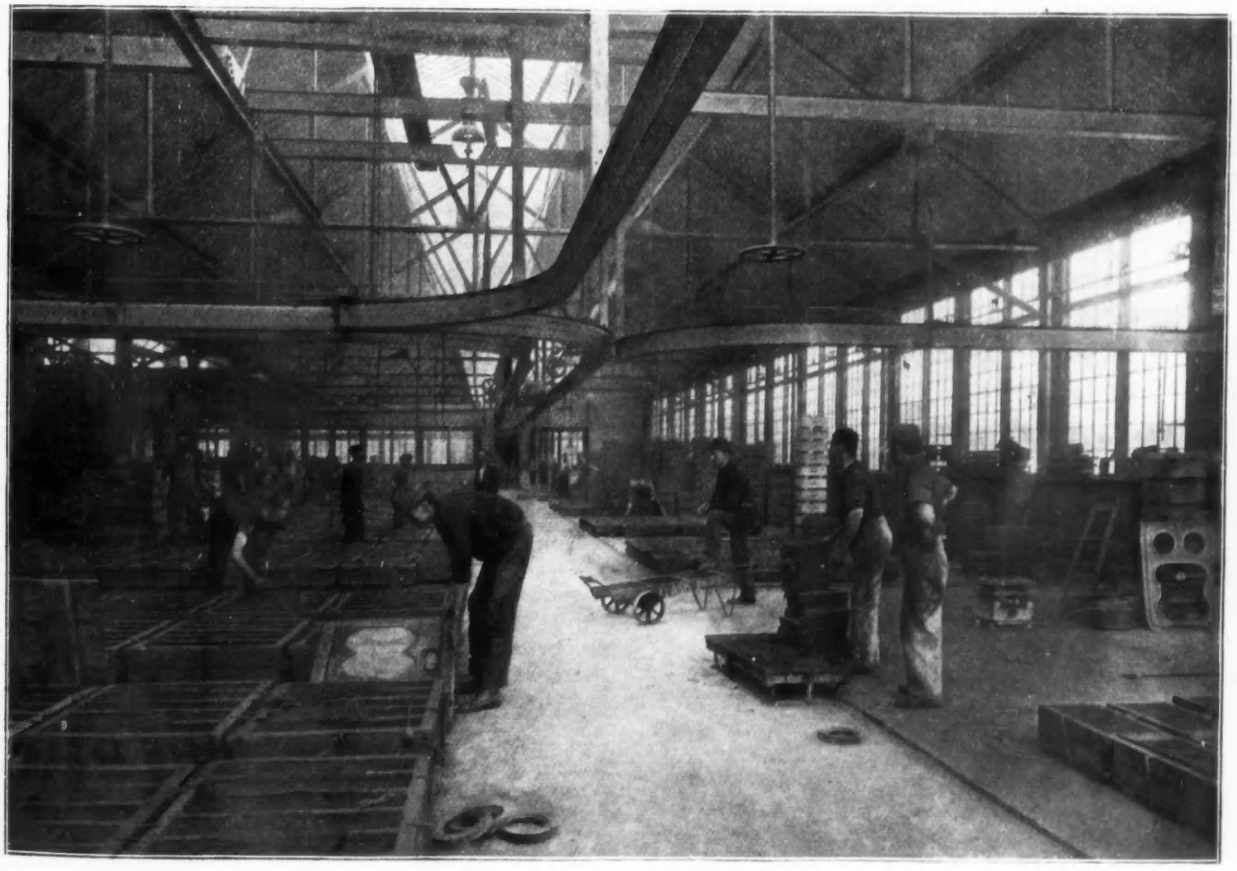


FIG. 6. GENERAL VIEW OF ONE SIDE OF FOUNDRY.

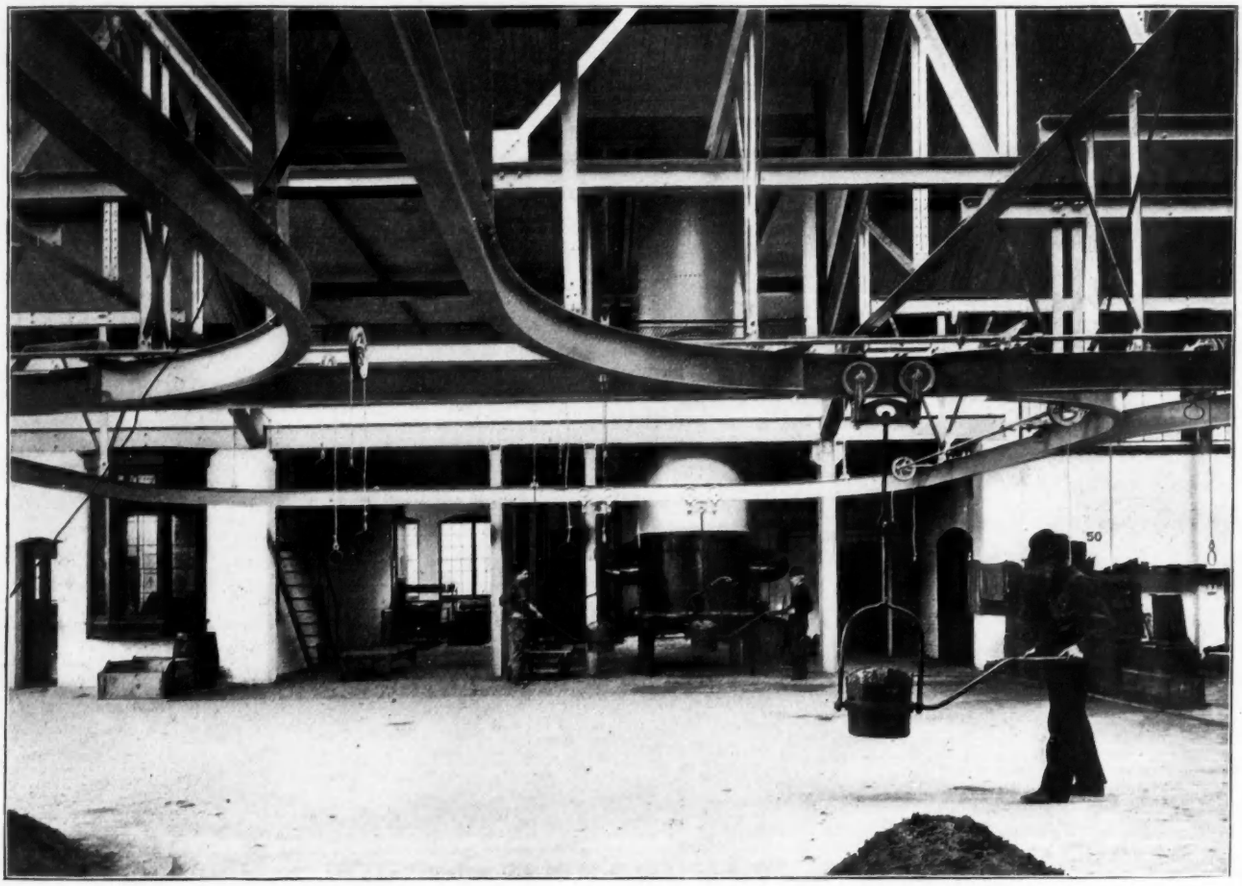


FIG. 7. FRONT OF CUPOLA, WITH LADLES AND OVERHEAD TROLLEY.

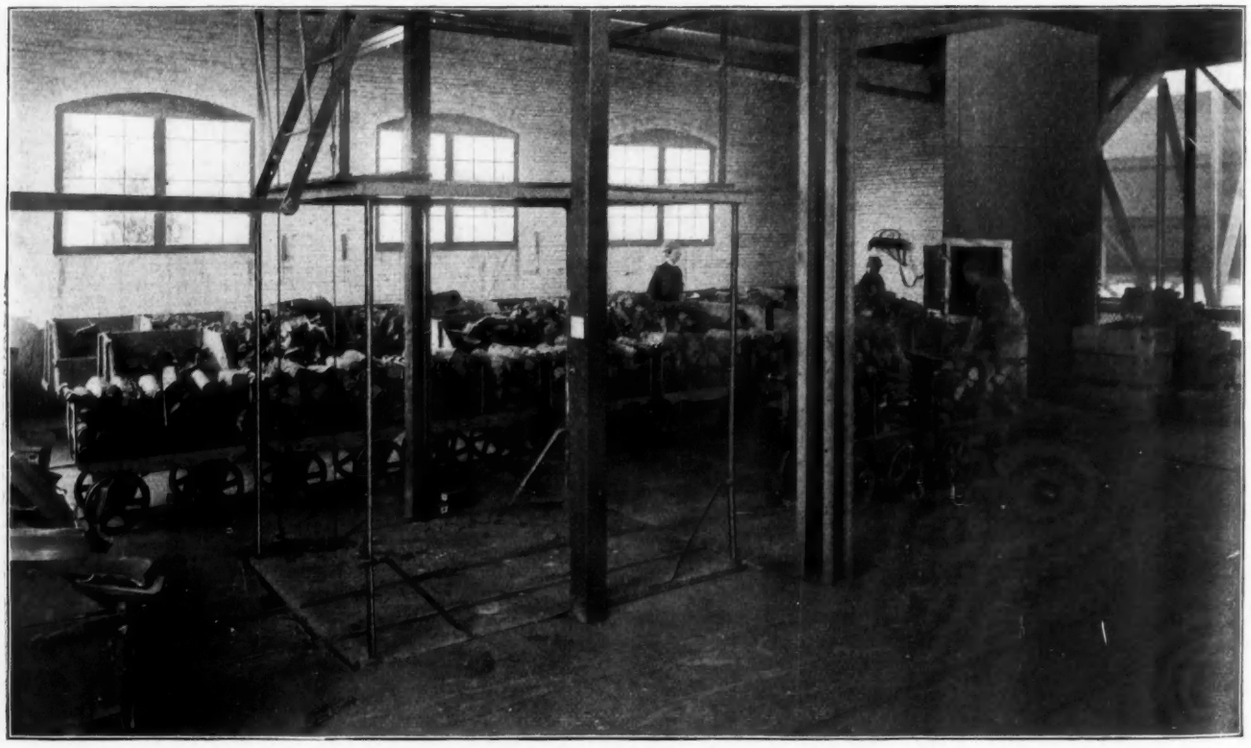


FIG. 8. CHARGING FLOOR, WITH THE DAY'S CHARGE OF COKE AND IRON.

plete houses in each. There are other houses not quite as pretentious, but still neat and comfortable.

Perhaps the most noticeable feature of the buildings of the establishment as a whole is the number of windows, or, as they are practically along the entire sides of most of the buildings, we might perhaps say the numberless windows employed. The designer evidently appreciated the double or triple fact that panes of glass cost no more than brick walls, that glass is the best transmitter of light, and that light is a good thing in most industrial establishments. The area of glass throughout the works, and including the warehouse and storage buildings, is about one-quarter of the floor area, while in the foundry, including its skylights, the glass area is more than 35 per cent. of the floor area. The buildings are all of one story, with the floors directly upon the ground, over a suitable foundation of broken stone, concrete and asphalt. All the buildings except the foundry have flat roofs of 2½-inch Georgia pine plank covered with tar-paper and gravel. The various interior views given convey a very clear idea of the style and character of the buildings without elaborate description.

FIG. 9. IN THE STOCK-HOUSE.

The foundry building is a single enclosure with a high-peaked twin roof, the only supports for which, besides the side walls, are the steel columns which rise from the central partition wall, which is only about a yard high, and serves as a backing for the sand heaps and the necessary piles of flasks. The steel trusses of the roof, all of the structural ironwork and the overhead railway are painted a light buff, and the roofs, which are of Georgia pine covered with slate, are painted with white water paint. The wide skylights extend the entire length of each roof, and each gable end is also practically all glass. As the work done in this foundry does not require any bedding or cutting into the floor, the entire surface, both molding "floors" and gangways, is covered with concrete, and only sufficient sand is required for actual use in the flasks. A wrought-iron bar set edgewise sharply separates the floors from the gangways, the latter being 1½ inches lower than the former. The gangways are 8 feet wide. The overhead track, which is seen in several of the views, is an important feature of this foundry. It is not used for the molding operations, as where any hoisting other than hand is required air hoists are used, each for its own individual floor. Several of these are seen in the background of Fig. 5. The overhead track, a plan of which in the foundry is given in Fig. 4, is a 10-inch I-beam, 25 pounds to the foot, 9 feet clear from the floor. The carriages, which have four turned wheels to each, have helical springs below the wheels to equalize the load and to prevent shocks. Switches, operated by depending chains and loop handles, make it possible to run any carriage to any part of the system. All the metal for pouring is carried by this overhead track to the molders, and none of it is caught at the cupola by them, thus greatly mitigating the most exhausting part of the molder's labor. Five men, each with a single-handled 800-pound ladle, carry all the iron. When pouring time comes, several pans or trays, like the one seen in the foreground in Fig. 5, are placed at the different parts where the iron is to be delivered, and the pouring into the hand ladles is done over these, and any iron that is spilled is caught in the pan of sand. The two-handled ladle is only occasionally used for the larger furnace castings, and was brought into play when the picture was taken, to give the photographer a better chance. Fig. 6 gives a fine general view, taken in the forenoon, of the interior of the foundry with the usual molding operations going on and the usual complement of men in their places. Very few helpers are employed, and practically none in the molding, as the men give each other all the help that is required. All the sand used each day is returned to the sand storage house, where it is dried over large coils of steam pipe and run through very fine screens before it is used again.

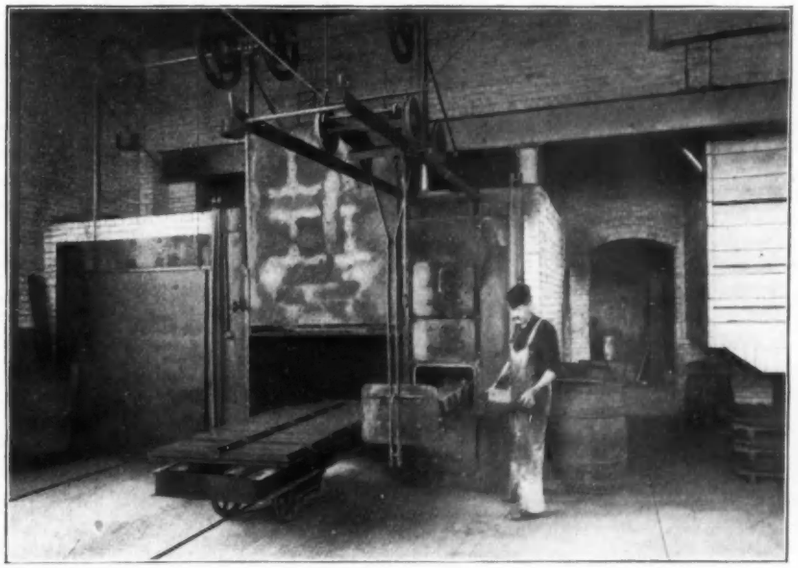


FIG. 10. CORE OVENS.

Fig. 7 shows the front of the cupola, with the men and ladles in position for conveying the iron. This picture was not taken while the pouring was actually in progress, but, for obvious reasons, earlier in the day. But one cupola is at present

installed, room for a second being provided when it becomes necessary to use it. A reference to Fig. 2 will show that all the buildings may be considerably enlarged and extended whenever the business demands it. The bay-window of the foreman's office is seen at the left in Fig. 7. This is in one corner of the core-shop, the core ovens being directly back of this office.

Fig. 8 shows the charging room, with the day's charge of coke and iron in position, the charging door being in the background at the right and the elevator by which the cars are brought up in the foreground. As fast as the cars are unloaded there is ample room at the right to leave them until they are all emptied. Nearest the cupola are the cars with wood for kindling and coke for the bed, then there are several cars which carry one charge each of coke and of scrap, and cars which each carry two charges of pig.

Fig. 9 is a view of the interior of the stock-house, with the pig-iron section in the foreground. The floor of this house is sunk low enough for the convenient unloading of all material from the railway tracks upon either side. A narrow-gage track runs through the middle, with turntables and transverse tracks into the different bins, also to the two subways leading to the boiler house and to the foundry. There is a slight down grade from the stock house, so that the loaded cars, which have roller bearings, are easily moved. In the track are also two platform scales, where the charges for the cupola are weighed as they are loaded, and no weighing is done in the foundry. The floor of the boiler house is sunk to the level of the subway, as is also the floor of the cupola house. On one side of this house are the furnaces for the core ovens on the floor above, and also for an oven where the molders' ladles are dried. The cars conveying sand to the foundry are lifted by the hydraulic elevator one story to the level of the foundry floor, while those with the coke and iron for the cupola are lifted two stories.

Fig. 10 is a view taken in the core-shop, showing the front of the ovens. The large door at the left is a separate oven, which is not always in use. Both the large doors are suspended by the wires depending from the large sheaves above, while the small sheaves carry the counterbalance weights. The four-wheeled carriage above, from which the double bar hangs, carries the weight of the front ends of the small oven slides. When either of them is to be drawn out the bars are brought to straddle the handle and a small cross-pin is inserted in the proper holes in the bars, catching under the upper end of the handle bow. The slides are always drawn out to their full length, when a plate at the back closes the opening. The ovens are built of two 8-inch walls with 2 inches of mineral wool between. The furnace being below, the coal, ashes and dust are kept out of the core shop. The heat of the ovens is regulated by a thermometer and ranges between 350 and 425 degrees. The axles of the cars in the large ovens do not turn in boxes, but roll along a planed surface of sufficient length to correspond with the short travel of the car in and out of the oven.

We may note by Fig. 2 how neatly the material coming into the stock-house makes the circuit of the establishment until it comes to the warehouse ready for storage or shipment. All comes in at one end of the foundry, while all the castings go out at the other end. The cleaning room takes in the entire end of the foundry building. Along one side of the room are ranged twelve tumbling barrels of original design. They are not mounted upon trunnions or driven by gearing. Each tumbler has two large circular heads of equal diameter, and these heads bear upon wheels upon a continuously rotating shaft which runs along under the entire line of barrels. A lever mechanism raises any barrel off the driving shaft when it is desired to stop it. The sand and dust are exhausted from the tumblers and carried to a centrifugal separator, and the refuse is carted away as it accumulates. From the cleaning room the castings go into the casting storage house, and as they enter here they are all carefully inspected, a rack with numbered partitions being provided for those which are rejected. The molders are permitted to trim such castings and save them, if they can do so and leave them perfect. A large stock of castings is carried in the casting storage, so that the lots for mounting may always be ready and complete as required. The stove mounting department has all the known facilities. In the machine shop, a view of which is given in Fig. 11, careful and accurate work is required upon the furnaces, which must be made steam and water tight and be subjected to a pressure test. Some large and elaborate jigs

FIG. 11. THE MACHINE SHOP—BUILDING HEATERS.

are required here and special drills, reamers, counterbores, taps, etc. The interior of the machine shop gives an idea of the ample hight provided in the flat-roofed buildings, which, perhaps, from the outside suggest different conditions. There is, of course, a nickel-plating department, as also a shop for tin and sheet-iron work, which require no special mention. The pattern shop is quite large, with a full equipment of saws, lathes, planers and the special tools which the pattern maker is learning to employ and appreciate. This shop finds large and constant employment in the upkeep of the patterns and in the making of new styles and designs by which the lead in business is maintained. In the pattern storage building the shelves upon which all the patterns are carried are supported upon adjustable brackets attached to vertical iron pipes. All the iron work and the entire interior is painted clear white. There are automatic fire doors and extra hand-operated doors in the several fire walls by which the building is divided. The flasks are all stored upon shelves attached to iron pipes which support the shed roofs, and no flask, nor, indeed, anything of any kind about the works, is left uncovered. All the buildings except the flask sheds are connected by covered passage-ways.

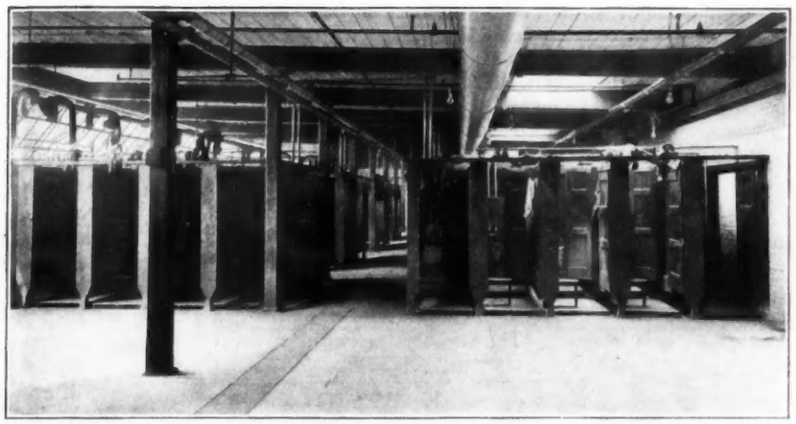


FIG. 12. PORTION OF MOLDERS' WASHROOM.

The warehouse for the finished goods occupies the building of the largest area of the entire plant, and it is practically all occupied and filled with material arranged in most orderly and systematic manner. On the side are entrances where wagons are backed down and in, bringing them just to the floor level, and at the back are two doorways and a railroad track where cars may be loaded.

In the matter of protection against fire, and in providing facilities for its rapid extinction, the same attention has been given to detail as in everything else about the establishment, and with such success that the rate of insurance is less than fifteen cents per hundred dollars of insurance carried. The buildings are as nearly fireproof as it is practicable to construct them. They are equipped throughout with automatic sprinklers, except in the molding room, the cupola house and the stock house, where they would do no good. There are eleven yard hydrants, besides four on the street, and three hose houses with hose always connected, a house with a spare hose reel, and in all about 1,500 feet of hose.

The power plant comprises a boiler room in which are three horizontal return tubular boilers, only two of which are used at once, each in succession being thrown out for two weeks at a time, and the engine room, which, besides the automatic cut-off engine for direct power, contains an electric lighting generator with 75 horse-power engine, a positive blower for the cupola, a belted and also a direct steam-driven air compressor, an engine for the ventilating fan, and duplex fire pump of 1,000 gallons per minute capacity. The water used is mostly obtained from driven wells, and all rain and return water is stored in a pond in the southeast corner of the grounds.

Not the least interesting parts of the entire establishment are the lavatories, bathrooms and closets for the men, shown in Figs. 12 and 13. In the former is shown a portion of the foundry washroom. Facing in the other direction would be seen the washbasins and water closets. This room is 105x35 feet. There are eighty lavatories, one for each molder, with room to add more when required. Each of these closets or rooms is 3x5 feet, and is designed especially for a sponge bath after pouring off. There are hot and cold water, a folding seat, a rack to stand upon, a large bucket and a locker with Yale lock for street clothing. The floor is of concrete with deep, open gutters. Fig. 13 shows the lavatory in the mounting shop. The washbasins are of special design, being of enameled cast iron, and any one is detachable if required. There are hot and cold water here, powdered soap in fixed canisters and plate-glass mirrors. The first cost of the whole is not prohibitive for other establishments, nor should the maintenance be. They certainly exist here not for show but for use.

It is one thing to design, and even to construct, equip and put into complete and successful operation such a nearly ideal plant as this, while, as wide experience attests, it is quite another thing to maintain it day by day and for a long period of time at the same altitude of excellence. To those who are familiar with foundries everywhere the attributes of orderliness, cleanliness, light, comfort and convenience are not the things most to be expected in such places, but these are the things most prominent throughout this establishment. The "picked-up" condition exhibited in the views here presented is the normal state of affairs in the works. The view showing the front of the cupola is the only one which was not taken under normal conditions.

FIG. 13. LAVATORY AND CLOTHING CLOSETS IN MOUNTING SHOP.

It is gratifying to know that while so much attention has been paid to the comfort and well being of the employees while

directly under the direction of the firm, they are also well paid for their services. We have seen some most gratifying figures showing the earnings of the men for the year just closed. We do not know, in fact, any place in the world where, in wages, the men could do better for the same line of work.

The leading and directing mind in the organization of this plant has been the president of the company, Mr. George W. Walker. To the superintendent, Mr. Bartlett M. Shaw, and the assistant superintendent, Mr. Thomas E. Inslee, we acknowledge our indebtedness for courtesies extended upon our recent visit. We understand that other visitors are welcome, and we failed to discover the slightest suggestion of any secret or of anything to be withheld or concealed about the entire establishment, in which particular it is typically American.

Originating an Index Plate.

Bevel gears for chainless bicycles must be of a high degree of accuracy. It is said, in fact, that no known system of mechanical testing or gaging, applied to the completed gears, will determine whether they are good gears or not. At the works of the Pope Manufacturing Company all gears are mounted in a testing frame and tested by the feet of an expert rider under conditions which approximate as closely as possible to those of actual riding, the smoothness of the motion as felt by the feet being the final or acceptance test.

The index plates used on the gear cutting machines at these works are special for each gear—plate and gear having the same number of teeth. The gears are made in immense quantities, and the plates are subject to a corresponding amount of usage. To avoid wear they must be hardened, and this, of course, adds greatly to the difficulties of making a correct plate.

We show herewith photographic views and sketches of a fixture designed to detect the errors of the plates after they are hardened and to correct those errors by grinding. The form of plate shown is that used on the Warren type of bevel gear generating machine, which was described in our issue of March 24, 1898. A large number of these machines are in use at the Pope works, and a full equipment of index plates for them has been made in the manner to be described.

The fixture employed is shown in the half-tones, Figs. 1 and 2, mounted on the cross-slide of a cutter and reamer grinder, and with an index plate in position. The fixture is employed both to determine the errors before grinding and to watch the grinding as it proceeds. The indicating portion of the fixture is mounted on an arm carried by the central boss, but not swiveling about it as might be inferred. It is shown, with a portion of a plate in position, in the sectional plan, Fig. 3. A pair of tong levers *a b* have finger ends to enter adjacent notches of the plate. The finger end of *a* is integral with *a*, but that of *b* is part of a separate multiplying lever which, at its outer end, has a zero mark registering with a second zero mark on the stationary arm below it. The registry of these zero marks is read by a magnifying glass, mounted as shown. Tong *a* is pivoted to tong *b* at *c*, and is backed up near its free end by the finger *d* of a micrometer caliper head, seen more fully in Figs. 1 and 2, and having an enlarged graduated circle reading to ten-thousandths. It should be said that one edge of the index notches is radial, one face of the engaging plunger in the gear cutting machine moving also radially with the plate, on the well-known principle of the Pratt & Whitney turret locking pin. The effect of this arrangement is to greatly simplify the correcting of the plate, as the radial edge only need be corrected. One edge being radial, it is the acting edge in the indexing, and lack of truth in the opposite edge can only affect the depth to which the plunger enters the notch, which does not affect the accuracy of the indexing. Should, however, both edges be at an angle with the radius, the center line of the notches would be the line which would determine the indexing, and both edges must, in that case, be positively true.

The two tong jaws and the micrometer will thus be seen to furnish means of comparing the spacings of the plate with great accuracy—not of measuring the spaces, but of determining how nearly they are equal to one another. In making this comparison the plate is stepped from notch to notch, the micrometer being adjusted until the zero lines of pointer and support coincide, when the micrometer is read and the reading is recorded. Were all the notches alike it is obvious that the zero lines would coincide without readjusting the micrometer head, the readings being all alike. The various actual readings being taken and tabulated, they are added together and divided by the number of notches. The quotient obviously gives the correct reading for a perfect plate, and by comparison of the quotient with the readings, the divisions which are too small and those which are too large may be determined.

An eight-notch plate is sketched in Fig. 4 with a set of hypothetical readings against the spaces. Performing the calculation described above, we have:

1.020
1.021
1.022
1.023
1.022
1.021
1.020
1.019

8)8.168(1.021

These figures show that some of the spacings are too large and some are too small, while two of them happen to be correct. It is obvious that if all the spaces gave the reading 1.021 their sum would be the same as in the actual plate, and the sides of the notches must be ground to give this common reading. At first sight it might appear that while some of the spaces are too small others are too large, and that the addition of metal might be necessary to make some of the correc-

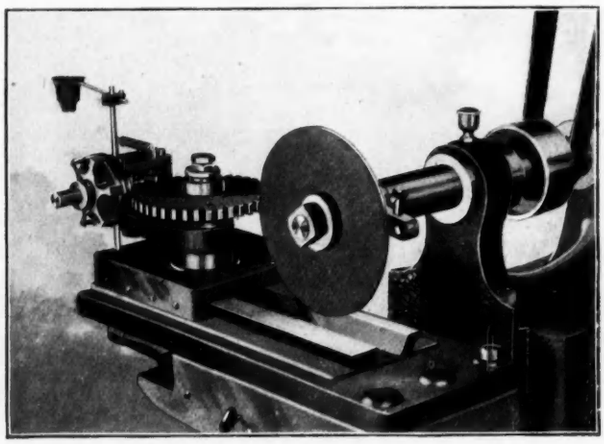


FIG. 1.

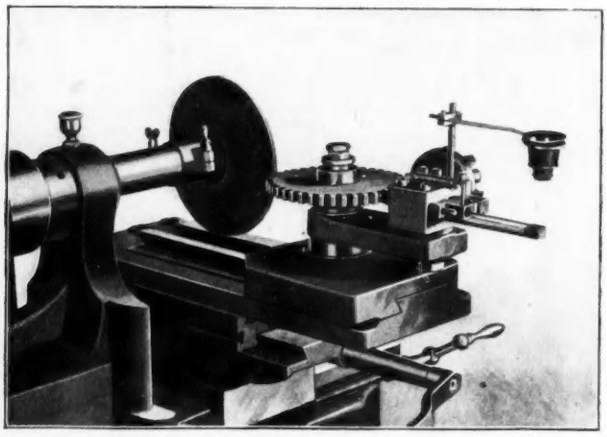


FIG. 2.

INDEX PLATE MEASURING FIXTURE IN POSITION IN CUTTER AND REAMER GRINDER.

tions. This, however, is not so, for the reason that each grinding changes two spaces. Thus if edge *b* of Fig. 4 be ground away, the grinding will enlarge the space *a b*, but it will also diminish space *b c*. In point of fact, by making a proper selection of a starting point we may find a notch compared with which the errors of all the others are either zero or positive—that is, that are either correct or have some stock to take off. This is important, as it is clearly impossible to add stock to any notch, the only possible correction be-

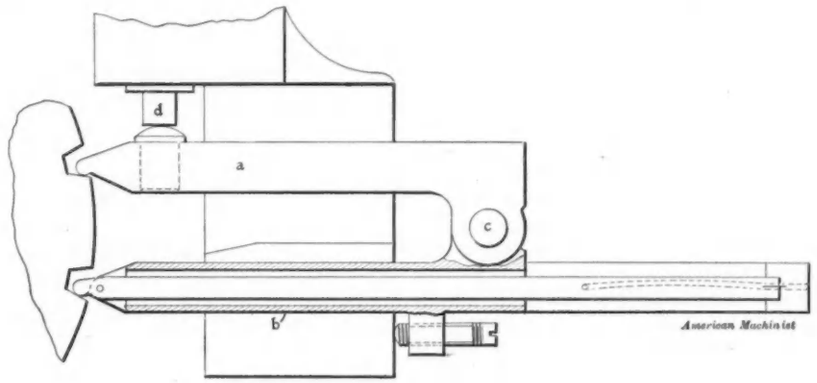


Fig. 3

INDICATING PORTION OF INDEX PLATE MEASURING FIXTURE.

ing that of removing some. The following will show how, by proper selection of the starting point, all errors become either zero or positive. Assuming edge *a*, for example, and adding the readings step by step, we find the sum of the readings, that is, the reading of each notch in succession measured from *a*, and by putting these in a column parallel with the multiples of the true reading, 1.021, we soon find whether notch *a* is the proper one to start grinding from, as in table 1:

Distance from	Actual Sum of Readings.	Correct Distances or Multiples of 1.021
a to *b*..	1.019	1.021
a " *c*..	1.019+1.020=2.039	1.021×2=2.042
a " *d*..	2.039+1.021=3.060	1.021×3=3.063
a " *e*..	3.060+1.022=4.082	1.021×4=4.084
a " *f*..	4.082+1.023=5.105	1.021×5=5.105
a " *g*..	5.105+1.022=6.127	1.021×6=6.126
a " *h*..	6.127+1.021=7.148	1.021×7=7.147
Complete circle	7.148+1.020=8.168	1.021×8=8.168

TABLE 1.—SUMS OF ACTUAL AND OF CORRECT READINGS, COUNTING FROM EDGE *a*, FIG. 4.

Inspecting this table shows that the notch selected will not do. Notch *b* is at a less distance from *a* than the required distance, giving some metal to come off at *b*, and the same is true of *c*, *d* and *e*. At *f*, however, the error vanishes, and at *g* it is in the wrong direction; that is, the distance from *a* to *g* is *greater* than it should be, and metal would have to be added at *g* in order to make the required correction. By beginning at *h*, however, as a starting point, we get Table 2:

Distance from	Actual Sum of Readings.	Correct Distances or Multiples of 1.021.
h to *a*..	1.020	1.021
h " *b*..	1.020+1.019=2.039	1.021×2=2.042
h " *c*..	2.039+1.020=3.059	1.021×3=3.063
h " *d*..	3.059+1.021=4.080	1.021×4=4.084
h " *e*..	4.080+1.022=5.102	1.021×5=5.105
h " *f*..	5.102+1.023=6.125	1.021×6=6.126
h " *g*..	6.125+1.022=7.147	1.021×7=7.147
Complete circle	7.147+1.021=8.168	1.021×8=8.168

TABLE 2.—SUMS OF ACTUAL AND OF CORRECT READINGS, COUNTING FROM EDGE *h*, FIG. 4.

Inspecting this table shows all notches to be nearer to *h* than is required until we get around to notch *g*, when the error disappears, as is obvious it should do from the reading back from *h* to *g*, being by accident the correct reading.

Comparison of the corresponding figures in the columns of actual and correct readings in the last table shows the amount of metal required to be taken off each notch, and to do this the fixture is adapted to be mounted on a cutter grinder in the manner shown in Figs. 1 and 2. Obviously the grinding can be done with the greatest precision, the process being watched as it proceeds through the micrometer head and the zero lines.

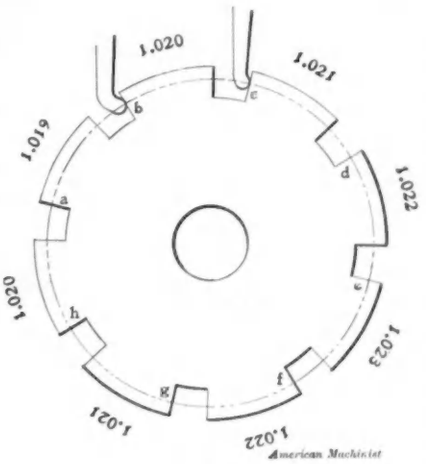


Fig. 4

SHOWING THE ERRORS TO BE CORRECTED.

It is obvious that by repeating the process and using sufficient care almost any desired degree of precision may be attained. We are not aware of any notched index plate intended to go right into productive service having been originated before. Most, if not all, original plates are master plates from which those in actual service are copied. It will be observed that the accuracy of the micrometer is of little or no importance to the final result, as it indicates but does not measure. When the plate is finished all notches read alike, and the micrometer divisions go out of the account.

The process will be seen to be a distant relative of that used by Professor Rogers, and described in our issue of May 25 last. With that circle the division was by lines instead of by notches, and the errors of the spacings were read by the micrometer eyepiece of a microscope. As the division of the circle was by lines, the corrections could be made in either direction, and there was no selection of a suitable starting point as in the present case, but fundamentally the methods of finding the errors and then correcting them are much alike.

Blowing Cores—And Other Blowing—At Mudville.

The old man and I had another set-to the other day, all about a question that I believe is of interest to a whole lot of foundrymen. The way it was was this: Every once in a while we would lose a lot of work from core blows. Now I haven't always worked in this foundry. I have had experience in straightening out things in several different shops, and I imagined I knew how to cure the core blowing evil. So I told the foreman of the core room to see to it that all flour and sand used in making cores should be measured, and I gave him the proportions that he was to use. He seemed to think I was stepping on his toes, at first, but after a brief parley concluded to obey orders. Now, I knew that these orders would be disregarded on the sly, until I should have delivered several orations on the subject; and in order to know whether my orders were obeyed or not I hung around the core room quite a good deal for a couple of weeks. By the end of that time we had got the proportions of sand and flour down to a fine art, and the blowing of cores from excess of flour was entirely cured. I had by this time become pretty well acquainted with my coremakers, including the foreman, and they apparently began rather to enjoy my frequent visits to their department; and this also includes the foreman. You see, I had a dead open and shut on them; the core blowing had been stopped for a whole week at a stretch, and they concluded that they could measure closer than they could guess.

Well, this frame of mind was what I had been working to produce, and I knew

that they would not be entirely won over unless my plan should prove uniformly successful; and I knew better than to risk the management of my plan in the hands of the enemy.

Feeling now safe in the matter, I relaxed my attention to the core business for a few days, but in less than a week we had a big batch of castings blown from the cores. I was deep in my interview with a coremaker who had fallen back to the idea that the old way was good enough when I heard the old man calling me. He was looking pretty lofty, and had both thumbs stuck in his armholes. "He's seen those blown castings," I says to myself, "and I'm going to catch it." "Say, Bucks," he began, "in most matters pertaining to practical mechanical operations within the lines of the foundry business, strictly, I am free to confess, Bucks, that you exhibit a high degree of aptitude!"

I began to feel better; evidently he had not seen those blown castings after all. I said: "Thank you, sir; it is not often that such words of praise"—— "But," he broke in, apparently not having observed that I was speaking. "But, Bucks, I want to give you a few hints upon some of the features of shop superintendence that pertain to my own capacity as general manager, in which, as might be expected, of course, Bucks, you are rather deficient. Now, Bucks," he continued, suddenly withdrawing his thumbs from his armholes and preparing to peck his left palm with his right-hand index finger, as was his habit when delivering himself of something very profound. "Now, Bucks, the secret of successful management is in diffusion." Here he threw back his head and looked at me from under his spectacles. Concluding, apparently, from the survey that I was "at sea," he canted his head forward and

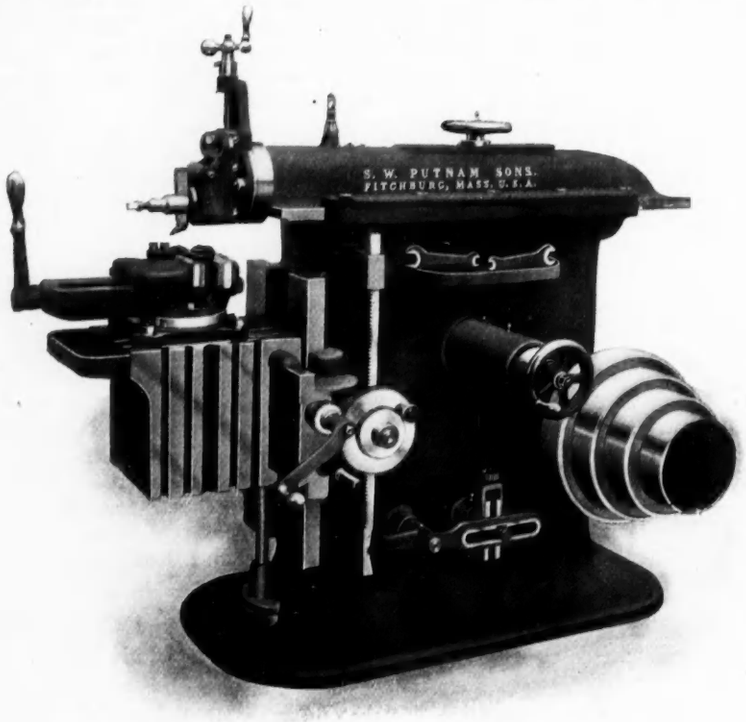


FIG. 1. SHAPING MACHINE WITH NOVEL RAM MOVEMENT.

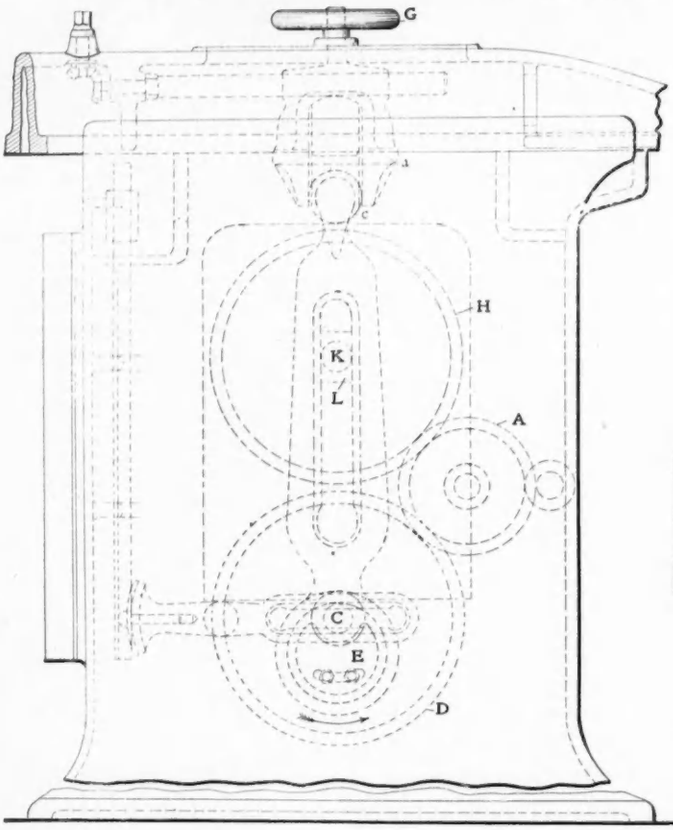


Fig. 2

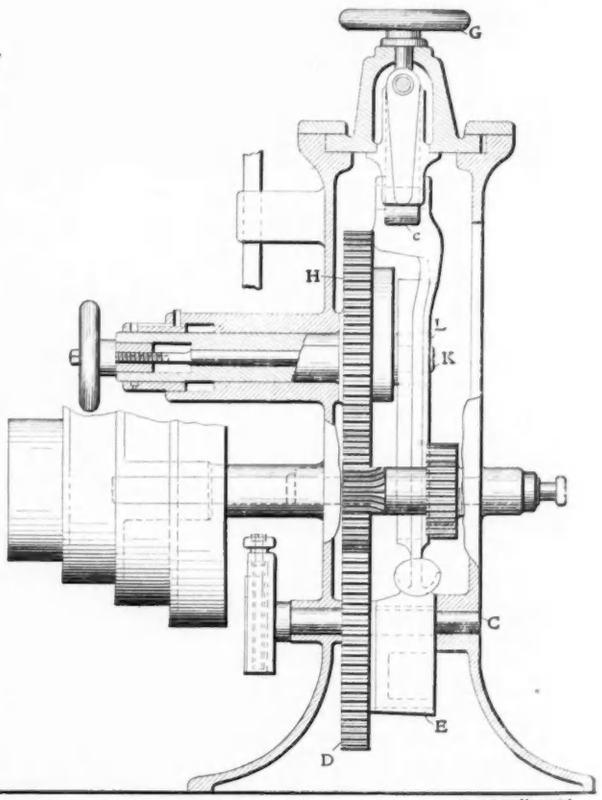


Fig. 3

THE RAM-ACTUATING MECHANISM.

tried to look over the top of his specs. "What I mean by that," said he, toying the while with my suspender buckle, "is, in brief, distribute yourself equally over the whole business; don't," here he pressed hard on the buckle, "don't give all your time, nor too much of your time to any one branch, but divide your time intelligently among all branches that fall under your charge. I find, Bucks, that you are giving your attention to this core room to the neglect of the other and more important parts of your business, one result of which is that we have this morning

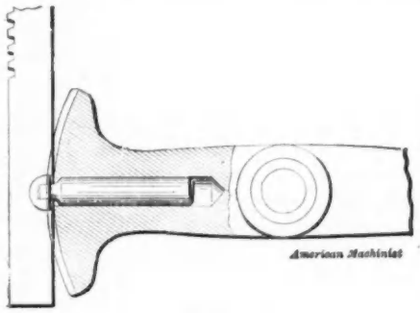


Fig. 4
DETAIL OF FEED MOTION.

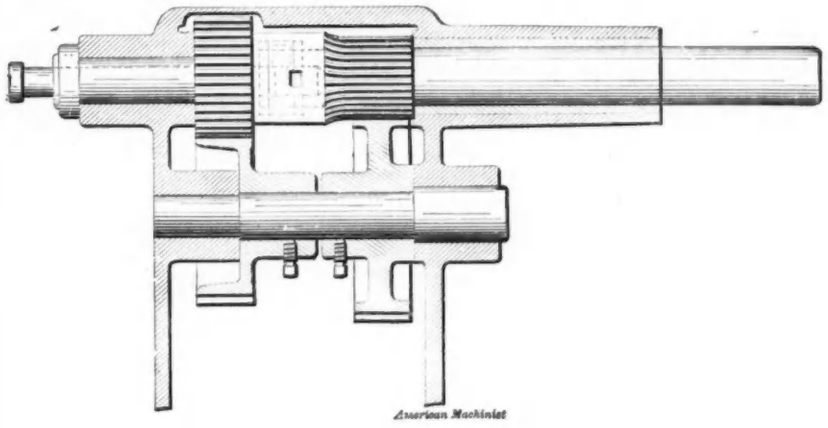


Fig. 5
TWO-SPEED DRIVING GEAR.

a lot of castings that are badly blown, and absolutely worthless!"

So, he had seen them, after all! I was rather hopelessly deliberating whether it would be worth while to try and make him understand that my attention to the core room had something to do with a well directed effort to prevent a recurrence of blown castings, when Smith, the junior partner, burst through the door and yelled: "Say, Bucks, you'll have to straighten out this coremaking business! Here's another big pile of castings core-blown! I thought we'd got over that! If them coremakers can't make decent cores without someone watching them all the time, why jest watch 'em, that's all!" "Yes," I said, "I've just been pulling them up about that, and I hadn't got done when Mr. Loftus called me away," and I went back to the core room and finished my lecture. When I came back to the molding room the bosses had gone out.—"Mr." Bucks in the "Tradesman."

A Shaping Machine With Novel Features.

The half-tone, Fig. 1, shows a shaping machine which should interest our readers by the novel features which it possesses, especially its ram-actuating movement. The mode of operating the ram of a shaping machine by means of a normally vertical pitman with a fixed point of oscillation at its lower end, a crank of adjustable throw operating, by its pin, a sliding block upon the middle portion of the pitman, while the upper end, by a sliding or rolling movement, moves the ram alternately back and forth, is sufficiently familiar. In the machine here shown the pitman is still employed, but its movement is no longer a simple vibration with the lower end as a fixed fulcrum, as will be understood by reference to Fig. 2. Here, it will be seen, are two horizontal shafts, one above the other, with similar gears *H* and *D*, each driven by the same gear *A*, so that they both turn in the same direction and at the same speed. Upon the lower shaft is the eccentric *E*, with a constant throw, but capable of a slight adjustment in either direction around the shaft. The lower end of the pitman is simply an eccentric strap or solid eye fitting this eccentric. A sliding and adjustable crank pin *K* on the face of the gear on the upper shaft works in the block *L*, sliding up and down in the pitman as the crank turns. The upper end of the pitman carries a roller *c*, which works in the vertical jaw *a* fastened to the ram. This jaw *a* is moved along the ram as usual, to change the working reach of the tool, by the screw and the miter gears, and is clamped by the hand wheel *G*. The pin *K* is moved to change its throw as described, and a graduated index at the outer end of the shaft shows always the stroke for which it is set (see Fig. 2). This pin *K* is shown in Fig. 2 in its central position, so that as the shaft rotates the pin does not move. It will be seen, however, that when in this position a considerable movement of the ram is caused by the throw of the lower eccentric, and it will be seen also that, with the eccentric revolving in the direction of the arrow, the movement of the ram must be slower when moving to the left or making its cutting stroke than when on the return stroke, because the eccentric will have a longer leverage in the former case than in the latter. The stroke of the ram is changed by moving the pin K and giving it the required throw. If, with both shafts standing in the position shown, the pin is moved downward, giving it a throw in the same direction with the eccentric, the stroke of the ram will be decreased; but if the pin is moved in the other direction, the stroke of the ram will be increased, and at any stroke a quick return and a practically uniform speed for the cutting movement will be assured.

The feed motion of the machine is indicated in the horizontal lever near the base in Fig. 2, and requires no explanation. The detail by which the vertical rack is driven is shown in Fig. 4. The little plunger carries a cylindrical cross-piece at its outer end, and this works in a cylindrical opening, comprising about 270 degrees, in the back of the rack, thus making a neat connection without lost motion. The length of movement of the rack is determined by the setting of the pin on the cross-slide at the end of the lower shaft. The driving cone has four steps, but in addition to this there are two different gear speeds, as shown in Fig. 5. The cone shaft has upon it two pinions of different sizes, and either of these may be clutched by sliding the central spindle which projects with a knob at the left. When either pinion is clutched and driving, the other runs free.

It will be seen that all of the operating devices of the machine are upon the working side. The stroke, velocity and position of the ram can be changed without stopping the machine. The motions being all positive, the cutting point works to a line, and the line may be located as precisely as desired. Large wearing surfaces are provided and a strong drive, with a good range of table movement in either direction. The shapers are being built in four sizes, with strokes, respectively, of 12, 15, 20 and 25 inches, by the Putnam Machine Company, Fitchburg, Mass.

The Western Electric Company, of Chicago, has a plant in Belgium furnished throughout with American machinery, and is conducted along American lines. In order to teach Belgian workmen the uses of this machinery and the manner of constructing telephone and other electrical devices by American methods, the company has just sent over to Belgium seventy-two skilled operators who will spend one year there.

Liquid Operated Machine Tools.

BY H. A. COOMBS.

In the issue of December 21 Mr. Tecumseh Swift discusses the advantages of using liquid pressure to operate the moving parts of machine tools, in place of the usual mechanical elements, such as gears, racks and pinions, feed-screws, etc. According to Mr. Swift, a good many people are now working along this line, and, if that is the case, it will be instructive and useful to see what has been already done, as far as that is possible.

We have in the Patent Office a sort of central station, which contains a fairly complete record of what has been accomplished in this line, or indeed in any other, not alone in this country, but also in many foreign countries. Since reading Mr. Swift's article, I have made a search for patents for hydraulically-operated machine tools, which has resulted in my finding a number of such patents, English, German and American, the numbers and dates of which are given below, and also a brief description of the invention in each case, which I trust will be of interest and of use to some of the readers of the "American Machinist." Tools in which a fluid is not uncommonly used for the application of power, such as presses, shears, power hammers, riveting machines and the like, are not included in this list, nor machines which are merely arranged to be driven by a hydraulic motor, such as portable drill presses, etc.

Mr. Swift, in the article above referred to, describes the application of hydraulic motive power to a planer as an illustration of the adaptability of such power for certain work, and there is none of the usual machine tools to which such power is more obviously suited. None of the moving parts of an engine lathe suggest to the observer the practicability of using a liquid under pressure to operate them.

While three patents have been found for hydraulically-operated planers, going back as far as 1868, the only other instances of the application of liquid power to machine tools in common use are found in two recent patents for turret lathes. A couple of patents for stone-working machines, of the general type of a metal-planer, and in which the reciprocating platens are operated by hydraulic apparatus will also be briefly described.

That the hydraulically-operated planer is not an invention of recent date is shown by the British patent to Robert Wilson, of Manchester, No. 3879 of 1868, in which is described a planer to the reciprocating table of which is attached the rod of a piston working in a long, double-acting cylinder supported on the bed underneath, to which the liquid under pressure is admitted through a valve-chest mounted at the center of the cylinder. The valve, which is presumably a "D" slide valve, is operated through levers and rods by two adjustable tappets on the table. At each end of the cylinder there is a vertical air chamber to prevent shock.

Next comes the German patent, No. 20749, granted in 1882 to Max Hasse & Co., of Berlin. In this machine there are three single-acting cylinders, two acting together on the forward stroke and the third, which faces in the opposite direction, to the other two, operating on the return stroke. The admission to and the exhaust from the three cylinders are controlled by a single "D" slide valve, operated by tappets on the table. There is a by-pass or shunt between the inlet pipe to the valve chest and the exhaust pipe, normally closed by a spring-controlled valve to relieve abnormal pressure.

The next inventor in this line, record of whose achievement has been encountered by the writer, is Paul Kühne, of Berlin, who obtained British patent No. 9200 of 1897 and German patent No. 98095. The patentee shows his invention applied to a planer and a metal-shearing machine. In the former the piston is stationary, being attached to the bed, while the cylinder reciprocates with the platen, of which, indeed, it is shown as an integral part. The water is admitted through two longitudinal passages in the piston rod, one going through the piston head to its outer side, while the other communicates with the cylinder space on the rod side of the head. Pressure is admitted through both passages simultaneously, the large area of the closed end of the cylinder compared with the area of its front end causing the forward stroke. Upon closing the longer passage, the cylinder and table are returned. A piston valve operated from the table controls the supply of liquid.

In the stone-dressing machine disclosed in the British patent, No. 803 of 1870, there is a reciprocating platen to carry the work, similar in every respect to the reciprocating table of a metal planer. In this machine, however, the four-way valve which controls the admission and exhaust is not arranged to be automatically operated, but is supplied with a hand lever for the use of the operator. One wonders whether he does not sometimes follow the example of the Cornish pumping engine boy, and tie a string to the hand lever so that it might be operated by the table. The piston is a long, hollow rod, supported at each end on brackets projecting from the bed of the machine, and with a head in the center. The cylinder, which is carried by the table, surrounds this piston, which is therefore necessarily longer than the length of the cylinder and stuffing boxes, plus the travel of the cylinder. There is a pump driven by the overhead shaft of the machine, and supplying water to a loaded accumulator, from which it passes to either end of the hollow piston rod and thence to the cylinder on one side of the piston head or the other. When the piston of the accumulator rises to a certain point, it uncovers an opening which permits the surplus water to flow back into the tank from which the pump takes its supply. The supply of water, and consequently the speed, can be controlled by the amount of opening of the valve, and also by shortening the stroke of the pump, which is driven through a link motion similar to that of a locomotive.

The United States patent to C. W. Theil, of Chicago, No. 578,429, granted March 9, 1897, is for a stone-sawing machine, the platen of which is hydraulically operated in a substantially similar way to those already described. There is a stationary double-acting cylinder, provided with a four-way valve operated by hand. There is a valved by-pass between the suction and discharge pipes of the pump, which latter is belt-driven from the main driving shaft of the saw. There is also a relief—or safety—valve on the discharge pipe from the pump, to prevent dangerous pressure. The water, as in the other machines where the pump is connected, is used over and over again.

It will be noticed that in none of these patents for planers and similar machines is there any arrangement, such as that suggested by Mr. Swift, for varying the speed according to the work being done. It is true that in the two stone-working machines different speeds can be obtained by varying the amount of water allowed to pass through the valve, and in the last described there is also the by-pass to limit the flow of water into the cylinder. But in the metal planers where the valves are automatically operated there is no speed-regulating device. It would seem, therefore, that such a device is unnecessary, because the resistance offered by the cutting tool is regulation enough. Thus, the pressure on the piston, being a constant quantity, would drive the table idly at a certain speed, which would be diminished when work was being done. In other words, the speed varies inversely as the resistance caused by the cutting tool.

In no case cited, either, is the feed of the tool operated by the same means as the table. To make the planer self-contained all that would be required would be some connection between the feed screw of the tool carriage and the valve rod or valve operating mechanism, so that whatever the length of stroke, the tool would be fed at each return movement of the table. For instance, the vertical shaft connected with the feed screw might carry a ratchet wheel at its lower end adapted to be operated by a pawl carried by a lever pivoted concentrically with the ratchet wheel and oscillated from the valve stem or lever. The amount of feed could be regulated by an adjustable shield, covering part of the teeth of the ratchet wheel, so that although the pawl would have a constant stroke, it would engage with more or fewer teeth, according to the position of the shield.

To turn from planers to another type of machine tool, there are several United States patents for hydraulically operated turret lathes. That patented by C. M. Conradson, of Madison, Wis., January 31, 1893, No. 490,864, is a very ingenious and quite complicated piece of mechanism. All the operations of the turret and turret slide are automatically performed. Adjusting mechanism is provided to adapt the movements of the slide to the different work performed by the various tools in the turret, so that all the movements of the slide are predetermined for each position of the turret. There is an arrangement by which the dwell between the backward and forward strokes of the turret slide can be made as long as desired. A satisfactory description of the machine cannot be given without practically reproducing the entire specification of the patent, which would be an entirely unwarrantable consumption of space. Suffice it to say that there is one hydraulic cylinder which reciprocates the slide and incidentally locks the turret, while the rotation of the turret and the movements of the valve regulating mechanism are accomplished from belt-driven shafts. There is a main valve and a regulating valve, for starting and stopping and for regulating the speed respectively. Screws of different pitch are cut in this way, without the use of a lead screw, change gears, etc.

The patent of J. Brockie, of London, No. 627,385, dated June 20, 1899, discloses an invention consisting of an automatic turret lathe having three hydraulic cylinders for operating the clutch on the headstock spindle, the cut-off slide and the turret slide, respectively. The valves are operated by solenoids, the circuits of which are closed at predetermined intervals by the contact of adjustable plugs carried on a rotary switchboard, the switchboard itself being intermittently rotated a step at the end of each backward stroke of the turret slide by means of a solenoid and pawl and ratchet. There is an arrangement by which the turret slide valve is partially closed during the forward stroke, so as to regulate the rate of feed of each tool.

Last, but not least, come the recent patents of Mr. James Hartness, whose name and "flat turret lathe" are so familiar to the readers of the "American Machinist." No. 635,887, granted October 31, 1899, discloses a completely automatic and self-contained fluid-operated turret lathe, which, as will be readily understood, is a pretty complicated piece of mechanism to undertake to describe in a few words. A very general statement of the salient features is all that will be attempted.

The source of power is an impact turbine wheel, from which the headstock spindle or "chuck carrier" is rotated, and from which the pumps are worked. The turbine wheel carries concentric series of blades, the stream being directed against any one of the series, so as to vary the power transmitted to the chuck, and consequently the rotative speed of the latter. The adjustment of the nozzles is controlled by the turret slide, so that the speed of the work is automatically adjusted to the requirements of each particular operation then being performed. There is a force-pump so connected to the source of power (the turbine) that the movement of the turret controls the stroke of the piston, and consequently the speed of the turret slide. To quote the specification of the patent, "Each movement of the piston measures off a predetermined volume of fluid, which is fed into the cylinder." An auxiliary pump and valve mechanism are provided to accelerate the "idle" movements of the carriage, so that no unnecessary time may be lost over unproductive movements of the machine. The turret slide, or carriage, is provided with a cylinder, sliding over a piston rigidly connected with the bed of the lathe. Concentric passages through the piston rod conduct the liquid to the respective sides of the piston. A piston valve, operated by adjustable "stops," controls the supply of liquid, and assists in varying the speed according to the work being done.

The machine of the patent No. 635,888—also granted October 31, 1899—has, as an additional feature, fluid-operated means for moving the work holder laterally; that is, at right angles to the reciprocating movement of the turret. The machine, as shown, takes its supply of liquid from some independent source, while the headstock spindle is belt-driven. Regulator devices are described, so arranged that the speed of the headstock spindle and the work controls the speed of the turret carriage.

In the fluid-operated lathe of patent No. 637,461, dated November 21, 1899, are combined the advantages attending the use of compressed air (or other gas), such as the ease with which it can be conveyed anywhere and controlled, and those incident to the employment of liquid pressure, as, for example, the steadiness of movement of the tool holder. The air is directed by a valve either into a receptacle containing a liquid, which is thereby forced out and operates the slide, or into the rear end of the cylinder to rapidly return the tool holder. A regulator proportions the speed of the turret slide to that of the chuck or work holder.

It is an easy matter for anyone interested to obtain or see copies of patents. Whether the hydraulic lathe will come into general use it is perhaps too early to say, but it does not seem as though the advantages of the hydraulically operated planer were real enough to make it a dangerous rival of the time-honored rack and pinion variety, although one was invented more than thirty years ago.

In conclusion I wish it to be clearly understood that I do not claim that my search was an exhaustive one, although I can say that I believe the list given above to be complete, as far as the United States patents are concerned.

Air as a Lubricant for a Journal Bearing.*

BY HERMAN S. HEICHERT.

Atmospheric air is now being used with good results for illustrating the action of a lubricant in an ordinary journal bearing, in a machine designed by Prof. Albert Kingsbury, of the mechanical department of the Worcester Polytechnic Institute. The machine is at present a part of the mechanical laboratory apparatus, and a series of experiments is now in progress for the purpose of further investigation.

The machine consists of a steel piston or short shaft, to be rotated, and a cast-iron ring or cylinder which acts as a bearing for the shaft, the whole being supported on rollers mounted on a suitable frame, as shown in the sketch. The shaft weighs 50½ pounds, is 6¼ inches long and 6 inches in diameter, and constitutes the total downward pressure on the bearing. The diameter of the cylinder is slightly less than a two-thousandth of an inch larger than the shaft—a fairly loose fit. Both cylinder and shaft are ground to exact parallelism.

The principal results so far obtained are: First, the demonstration of the formation of a film of air between the cylinder and shaft when rotating, so that the shaft is actually floating on the air and is not in contact with the cylinder at any point. Second, the determination of the position of the shaft relative to the ring, whether eccentric or concentric, and changes in its position with changes in speed of rotation. Third, the determination of the pressures existing in the film of air at different points around the shaft and the change of these pressures with change of speed. These results were accomplished in the following briefly stated manner:

The cylinder is set horizontally, the shaft inserted in it (both being perfectly clean and dry) and rotated with the hand by the handle shown at the end. It can be turned with difficulty at first, and the harsh, grating sound of metal rubbing on metal will be heard. With an increase of speed, however, this grating ceases and the force required to turn the shaft is materially decreased until, after a few revolutions, the shaft becomes entirely free from the cylinder and rotates on the film of air between. Set rotating at, say, 500 revolutions per minute, it will continue to rotate four or five minutes. If allowed to run, the speed gradually decreases from the start until suddenly the piston breaks through the intervening layer of air and

*From "The Rose Technic."

a few more revolutions suffice to bring it to a sudden stop.

If a more conclusive proof is required that the shaft is entirely separated from the cylinder, an electric bell may be included in a circuit of which the shaft is made one terminal and the cylinder the other, when it will be found that the bell is silent as long as the shaft rotates at any considerable speed.

To determine the position assumed by the rotating shaft in relation to the cylinder, it is only necessary to remove one of the plugs shown in the top of the cylinder and insert in its stead a micrometer screw. We have then at once a means of determining the position of the shaft by rotating the cylinder on its supporting rollers and reading the micrometer screw at the several positions around the circle. The electric bell may again be used to determine when contact has been made between the micrometer and the piston. Tests of this character show that the piston occupies a position below the center and in advance of the lowest point on the cylinder circle. For example, if in Fig. 2 the shaft be represented as rotating in the direction of the arrow, the point nearest the cylinder will be in the vicinity of *S*. The higher the speed of the rotation the more nearly will the axis of the shaft coincide with the axis of the cylinder. The point *S* will also shift its position somewhat with variations of speed. By reasoning alone one would probably conclude that the point *S* would lie near the bottom, but to the right-hand side of the vertical diameter, the piston rolling up on this side before any sliding action begins. In stopping and starting this is no doubt true, but as soon as the speed is sufficiently high to cause contact to cease the shaft will occupy a position as described above.

The third point, a determination of the pressures existing in the film of air, is made in the following manner: A connection is made by means of a small rubber tube between one of the holes drilled in the cylinder wall and a mercury manometer (a U tube partially filled with mercury). This done, and the shaft set rotating, the pressures may be measured in inches of mercury by rotating the cylinder on the supporting rollers (as was done in finding the position of the shaft), at as many points around the shaft as desired. Minimum pressure will be found at about the point *A*, and will be a partial vacuum, the highest noted being about two pounds less than atmospheric pressure. The point of maximum pressure will be found near *P*, a little to the right from *S*, and running up to about three pounds per square inch above atmospheric pressure at some speeds. The pressure curve in Fig. 2 is a fair sample of the pressures existing around the shaft, pressure at any point being laid off to scale on a radius through that point, from the circle of atmospheric pressure. Leaving friction out of account, the resultant vertical force should, of course, be equal to the weight of the piston. This peculiar distribution of pressures would seem to indicate that the air is drawn out of the wedge-shaped opening near the top of the cylinder and forced into the same shaped opening at the bottom. Pressures along an element of the cylinder near the bottom will show an increase from zero at the ends, which are, of course, open to the air, at atmospheric pressures to a maximum at the middle. An element near the top will show atmospheric pressure at the ends and a less pressure as the middle is approached.

The cylinder, as will be noticed, is closed at one end and is air-tight except when the valve is opened, which is necessary when the piston is to be withdrawn or inserted. If both ends are left open, it is found practically impossible to level the cylinder with sufficient precision to prevent the piston traveling axially when rotated on its air lubricant—another proof of the small amount of friction. A few drops of oil allowed to run into the bearing will cause sufficient friction to stop the shaft in a very few revolutions, likewise a little rust or slight abrasion on one of the surfaces will cause the experiments to fail.

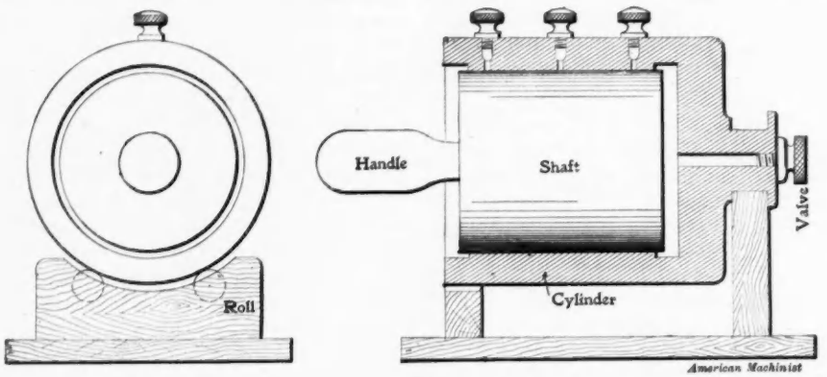


Fig. 1

APPARATUS FOR SHOWING THE ACTION OF AIR AS A LUBRICANT.

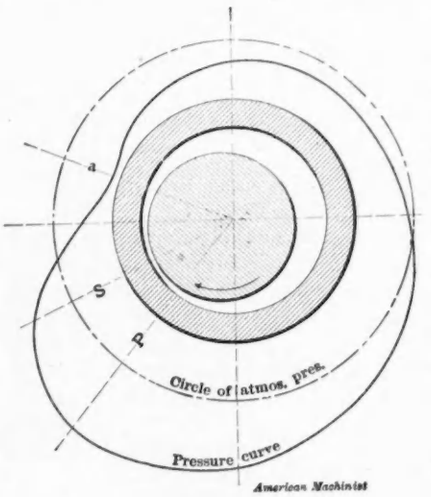


Fig. 2

DIAGRAM SHOWING CURVE OF PRESSURES AND LOCATION OF SHAFT IN ITS BEARING.

Letters from Practical Men

Machine Work on an 84-Inch Sluice Gate.

Editor American Machinist:

There have been some very fine examples shown in the "American Machinist" of how big work is sometimes done in small shops. Jobs come along every once in a while which put the best of machinists to thinking. We do not claim anything new in the operations here shown, but they may be of interest to some readers, as the writer has been benefited by others.

Fig. 1 shows a sluice gate recently built by us for the Cleveland Water Works and believed to be one of the largest in existence. Its total length as shown was 16 feet 2 inches, its width 8 feet 5 inches and its finished weight 30,200 pounds. It is to be placed in a well 30 feet below the surface of the ground. The bronze screw shown is 10 feet 10 inches long and 4½ inches in diameter, 2 pitch, bastard thread. This is connected by a flange coupling to a steel stem 3 inches in diameter and 18 feet long, which is steadied in a cast-iron frame above and carries a large spur gear.

It was necessary to face a large surface on the top side of the main casting to which to bolt the long bracket. Our largest tool is a 10x16-foot boring mill, which will take just 8 feet under the tool, while the length of the casting was 8 feet 4 inches. Fig. 2 shows how we bolted the sluice gate to the cross rail of the boring mill and supported it from the bed of the machine with jackscrews and timbers to take some of the weight off the cross rail. We took the planer rail and bolted it to the face plate of the boring mill, made a special facing tool standing straight up, fixed a star feed, and then we were ready to start, and the results were very satisfactory.

Another photo, which was a failure,

would have shown how we made a combination of our planer and radial drill to do a job of milling. The milling to be done was on the parallel guide strips on each edge of the disk, and on the bevel or inclined strips at the back, which came to a bearing in the final act of closing the valve. In Fig. 1 the gibs for the straight

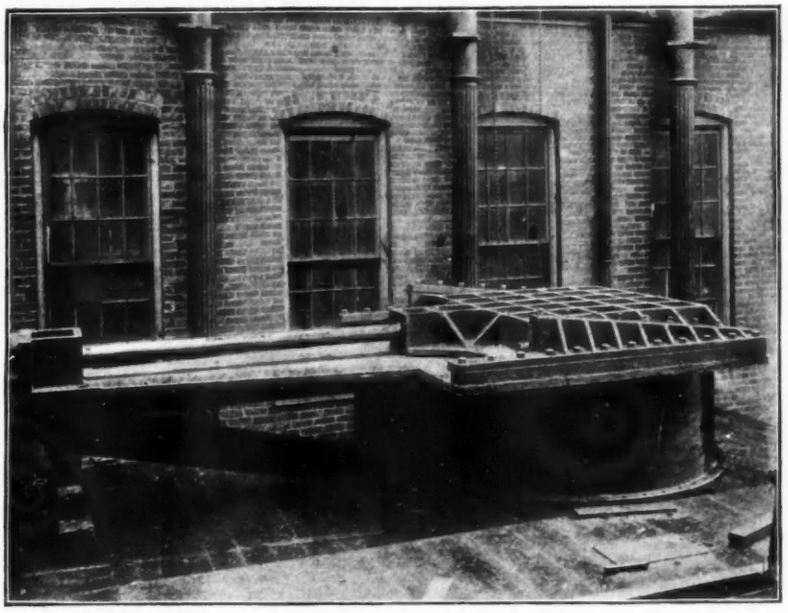


FIG. 1. 84-INCH SLUICE GATE.

slide of the disk have also inclined lips which lap over those bevel strips on the back of the disk. We took the sides and all the upper work off the planer and set it in position, leveled it up and fastened it under the arm of the radial drill. We got a belt with a very slow movement on to the pulley to feed the platen along, and then we set the disk on to it, tipping it up so as to bring the inclined strips level. Then we had a milling cutter of sufficient diameter on the drill spindle, and, feeding the disk along under it, milled the inclined faces very nicely. Then we fastened the disk down flat on the platen and milled the parallel strips. As the platen was only 36 inches wide, while the disk was 91 inches, the latter was supported right under the cutter by a roller. The feed on the job was about 1¾ inches per minute. The work came from the machine in quite a satisfactory condition, and we had very little fitting to do.

J. D. WEIR.

Supt. Michigan Brass and Iron Works.
Detroit, Mich.

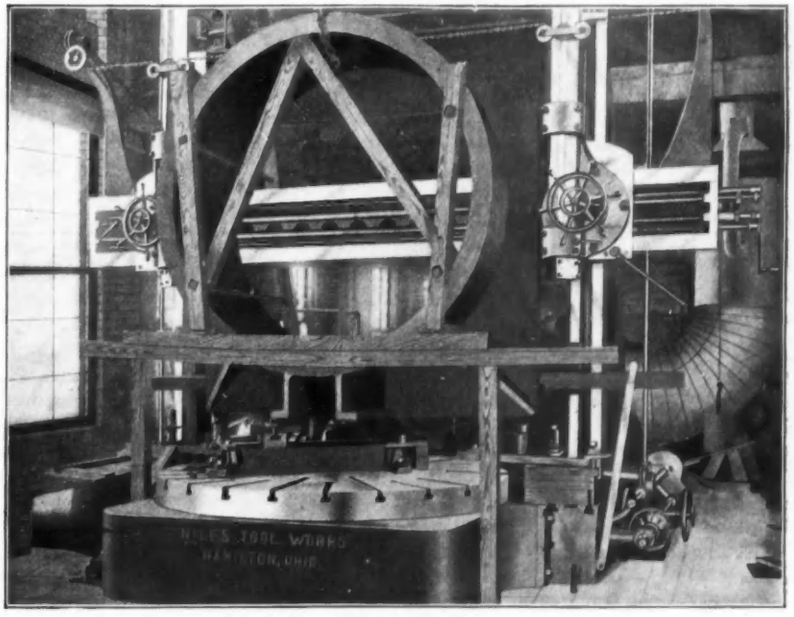


FIG. 2. FACING A BIG CASTING.

"The Salary Expected."

Editor American Machinist:

Those who are "constant readers" of the "American Machinist" know that Mr. Tecumseh Swift has a knack of saying interesting things. Some time since, he wrote interestingly of the "Help Wanted" column, and spoke of the ad. inserted by some foreign firm offering £3 and some chicken feed for a man who is *usually* paid in the United States not less than $25 per week. He also quotes from that able editorial which says, among other things, that "when men leave a shop of their own volition, apparently because of some grievance or dissatisfaction, and while their services are still desired within it, they should be requested to state the reasons for their leaving." But let not Mr. Swift, or any other Mr., think that the land of pounds and pence is the only one in which such things occur.

If you can spare the space, I would like to tell the experience of a friend of mine. In the first place, long ago, when he was going to school, his father said, "R——, I didn t have the benefit of a good education, and I feel the lack of it. Now, I want you to have a college education; but before you go to college, I want you to go into the shop and learn the practical side. I'm making enough to furnish the soap and water, so the dirt and grease won't hurt you, and the practical knowledge will help you wonderfully, both in college and after." Bless him! it has.

So R—— learned the trade. When he first entered the shop as a "cub," he considered himself to have a "pull"—because his father had—but my! the shop soon cured him of that idea. Just as was intended. Then he studied electrical and mechanical engineering, left college, and was ready for business. The first job was the installation, and, for a time, the superintendence of an isolated electric plant, then the promotion to a responsible foremanship in charge of many thousand dollars' worth of machinery.

But there car e a time when R—— earnestly desired to get into motor carriage work, and he applied for a position as draftsman in one of the rising companies. The president, who was not himself a mechanic, realized that they did need a draftsman, and he got the place. In ten weeks from that time he had completed over sixty sheets of working drawings, comprising the parts of four sizes of carriage motors, the largest of 30 horse-power, for trucking purposes. The company had been working for a year without a single drawing, and thousands of dollars had been wasted, needless to say. Then R—— said, "Jess [the superintendent], you need an index for patterns, drawings and stock, a series of job numbers, a system of cost-keeping and a first-class stock-room." He got up the index,

etc. The president was delighted and adopted them. Then R—— put away his instruments, put on a cap, jumper and apron and fitted up a stock-room which caused more felicitation.

Then said R—— to Jess, "Don't you think if you had some jigs and gages, you could cut the cost of your work in two?" "Yes, we could. Wish you'd make some." R—— did it—first-class ones, too. Then the president came around and said, "R——, I want an inventory gotten up in first-class shape. The commercial agent is coming around. Get it done as soon as you can." Done it is.

Now, the interesting part comes. The president found out when he began to hire men that could do good work, that he couldn't get them for less than $15 per week as the minimum figure, and he always pays the minimum figure. Now, R——'s salary before he went to this place used to exceed this very comfortably and he's tired of it, and while he still saws wood to keep things moving, he's looking around. What do you think of it, Mr. Swift? O. Mye.

A Blanking Die With Guide-Pins for the Punch.

Editor American Machinist:

Were you ever tried to the last notch with a small punch shearing in the die, and with work that should be smooth coming with a burr around the edges? For just such a case, in one of the small shops in the Naugatuck valley, I found the remedy here described, which proved satisfactory.

The blank was of cold rolled stock, No. 4 B. & S. gage (0.111 inch) with five holes No. 50 B. & S. drill gage (0.07 inch), these to be flat and very smooth, and above all to be made very cheap. Several attempts in our presses failed to give the required result, so we made a tool as per sketch, which perhaps is rather patterned after a subpress, though better than that for our work. The base and the punch holder are of cast iron. The four pins of tool steel hardened and ground and a good working fit in the holder, the holes of which had been bored when all were clamped together.

The die was made and keyed in the base. The punch holder was adjusted to the pins. The block for the punch was screwed and doweled on. The main punch was fitted with the holder on the pins, was hardened and the small round punches lapped to fit. It was keyed in the press, one with a rather narrow gate so that the pins could clear when at the lowest point. One boy with finger feed and press running 250 per minute cut out 450,000 without any further attention, and the tools would have gone a much longer time without sharpening. The additional expense, in proportion to the better results secured, is nothing, and the toolsetter can never shave the punch just a wee little bit. Iron Quill.

Inverse Proportion.

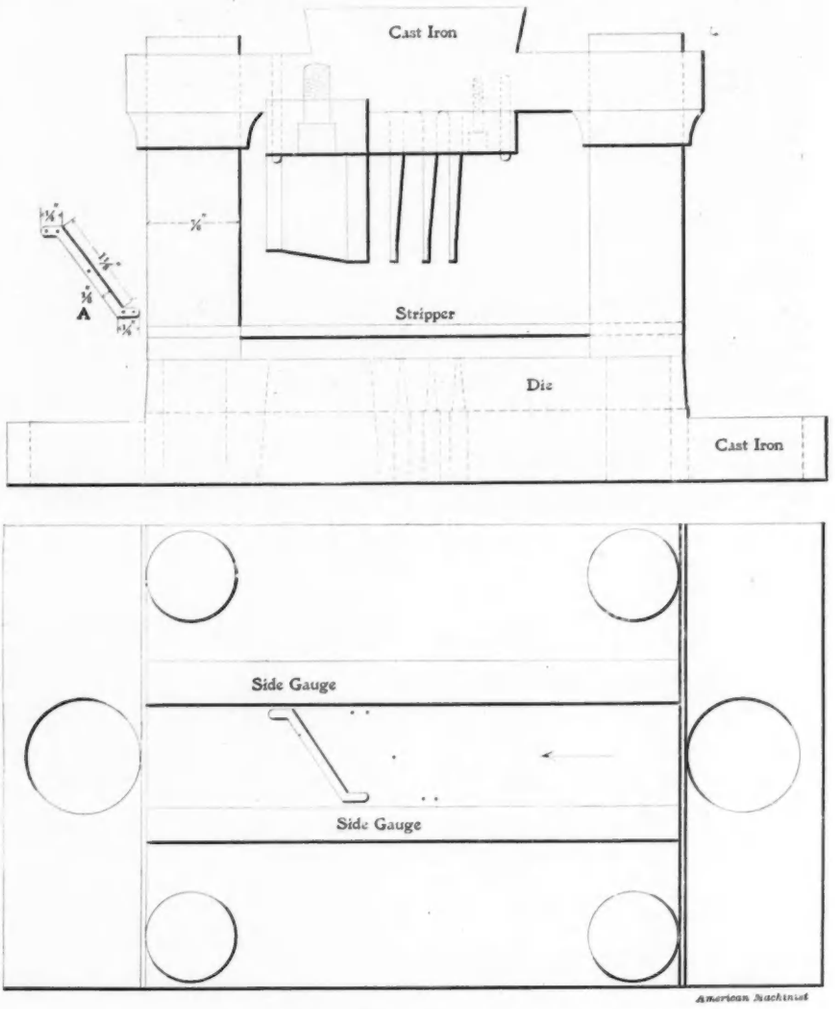
Editor American Machinist:

I am again in trouble, and come to you for assistance. This time it is over inverse proportion. Have searched all the books in my possession and asked teachers and others, without getting the desired information. What does "inverse" signify? Should think that examples below stated were nothing but simple proportion, and fail to see why inverse should be mentioned, viz.: If a thermometer registers 40 degrees at a distance of 10 feet from a heater, what will it register at 15 feet?—which everyone knows will be less; but it is stated, "By inverse proportion we have"

$$15^2 : 10^2 :: 40 : 17.7 \text{ degrees.}$$

And again in yours of the 30th ult. you say that the relation between the pressure per square inch in a 2-inch pipe and the air pressure will be *inversely* as the squares of the diameter of the pistons. The pressure on 2-inch piston would be greater than on the 12, so make 2 the first term and 12 the second, then the proportion would be $2^2 : 12^2 :: 80 : x$, or 2,880 pounds, which is as you have it. I am unable to see why these are not cases of simple proportion, nor find anyone who can inform me; so that if you can set me aright, would appreciate your kindness. I suppose that the last example applies to steam pumps also. C. S. F.

[Your letter shows that you understand the thing itself well enough, and you are only misled a little by a name. The cases you give are of inverse proportion simply because the fourth term of the proportion changes, *i. e.*, is made greater or smaller *inversely* to the increase or decrease in the third term. If the thermometer would register higher as it was moved away from the heater, then we would have *direct* proportion; but as it falls, or registers *less*, as the distance *increases*, we say that its hight is *inversely* as the square of its distance. The same with two cylinders. If they are both fitted with pistons connected to the same piston rod and pressure is admitted to one of them, then the static pressure per unit of area in the two cylinders will be related to each other *inversely* as the squares of their diameters. But if the pressure per square inch were greater in the larger cylinder, we would say that the pressure was *directly* proportioned to the squares of the diameters.—Ed.]



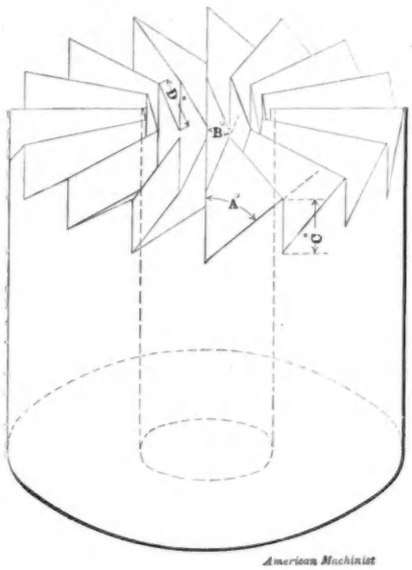
BLANKING DIE WITH GUIDE FOR PUNCH.

A Problem in Clutch Milling.

Editor American Machinist:

I hand you herewith a problem in universal milling that has occurred with me in machine construction, and as I have found very few machinists that have been able to do the problem, I ask you (if you consider it a fit subject) to have your mechanical expert or those of your readers who may be so disposed to give a solution of this problem through the columns of your valuable paper.

I have a sharp-tooth clutch to mill, as shown in the accompanying drawing, and have a Brown & Sharpe No. 1 milling machine to do the work with. It is necessary that the points marked *C* and *D* should be of the same depth, and this will necessarily make the angles *A* and *B* differ. When two clutches are milled in this way they will fit exactly without showing any opening. I hope I shall see some interesting solutions of this problem.



A MILLING PROBLEM.

WM H. SMITH.

The Sloping of Steam Pipes—Paper Driving Ropes.

Editor American Machinist:

In your issue for December 14 you publish the opinion of Professor John E. Sweet as to the direction in which steam pipes should slope—whether towards the engine or towards the boiler. Probably the majority of practical men who have the requisite experience to go upon will endorse the Professor's view that the pipe should slope down to the engine; but, nevertheless, there are to be found many who maintain the converse arrangement to be the correct one. Personally, I know of at least three mill engine builders of repute who adopt the latter plan and claim to have had no trouble of the kind so graphically depicted by Professor Sweet. With such a conflict of opinion, the question might almost appear to resolve itself into, not in which direction the pipe should slope, but rather whether it is necessary or desirable to slope the pipe at all.

It is evident that the object sought in grading the pipe is that water lying in it shall drain away under the action of gravity. But with a slope toward the boiler this can only occur when there is practically no movement of the steam taking place in the pipe; for it is inconceivable that any such movement of the water can independently occur when a relatively large volume of steam is sweeping through the pipe at a velocity of, perhaps, 6,000 feet or 8,000 feet per minute.

I recollect listening to a discussion on this subject a few years ago, and in the course of an interesting debate, a well-known builder of large mill engines cited a case in which he gave a rise to the engine of only 2 feet in a total length of steam pipe of 180 feet, and in which there was neither a separator, a steam trap, nor even a drain cock, but with which no trouble was ever experienced with water-hammer action.

A manifest objection, however, to the plan of draining toward the boiler is found in the accumulation of water of condensation close to the boiler stop valve when the latter is closed, and unless means are taken to remove this before the valve is opened, water-hammering may be set up to a very dangerous extent. How this was provided against in the above mentioned instance, I am unable to say; but it it evident that efficient means should be provided to ensure the removal of this water before the valve is opened, more especially if the pipe is short and steeply graded. With the reverse grading of the pipe no such measures are called for, and thus it appears to me as one of the best reasons for the adoption of the more general arrangement.

With fairly long pipes which slope towards the engine, it has been remarked that when the engine is standing and the steam in the pipe—although of the full boiler pressure—is in a quiescent condition, the discharge from the trap at the engine end of the pipe is only small in amount. As soon, however, as the engine is set in motion, copious discharges of water follow in rapid succession. This in many cases is largely traceable to badly arranged piping in which the water finds lodgment; but it also goes to show that the grading of the pipe is of little value in clearing it of water, and suggests, as I have previously remarked, that the practical advantages of sloping steam pipes are open to question.

During the last quarter of a century innumerable materials have been suggested from which to manufacture belts and ropes for power transmission. Among the various substances suggested, paper would at first sight seem to have little to recommend its adoption; but belts of this material have long since lost the distinction of novelty, while more recent experiments have shown that paper ropes have claims to consideration which cannot be lightly dismissed. As commercially manufactured by a British firm of ropemakers, the paper driving rope is constructed much upon the plan usually adopted in making those of cotton and manila, the main strands being formed of a number of smaller strands composed of strips of paper pulp. The material is treated with boiled linseed oil, and although of much less tensile strength than either of the fibrous ropes generally employed, it appears superior to them in respect to the manner in which it wears, becoming smoother in external appearance and more supple generally. Splicing is effected in much the same manner as with cotton or manila, but, as might be expected, a somewhat longer splice is necessary to ensure a continuity of streng.h. Experiments show that as regards the coefficient of friction of paper ropes in cast-iron grooves, the new rope is about 25 per cent. better than cotton ropes of ordinary make. Much, of course, will depend upon the durability of the paper rope, and this is a matter which only lengthy trials will establish, but experimental drives now running appear to be quite in favor of the new rope as compared with cotton. In the matter of weight, the advantage also lies with the paper transmitter of power, and in general the new departure seems to promise well. M. E.

[In the Transactions of the American Society of Mechanical Engineers for 1895, page 607, will be found a discussion by Mr. Chas. E. Emery which details a piece of experience bearing directly on the draining of steam pipes, and on that account we make the following extract from it: "It should always be recollected that the water follows the slightest current of steam. I supposed when starting the uptown plant of the New York Steam Company that when running only 20 or 30 horse-power in a 10-inch pipe at a sharp grade, I could drain the pipe back under the steam, and at a later date distribute the condensation to the several houses. On starting, the water was carried along with the steam into the houses, periodically blocked up the heating apparatus and gave the occupants trouble. I had to dig down at two places to the pipe and connect traps to remove the water at intervals, when there was no further trouble. Such experiences settle the principle that in the arrangement of steam pipes the water must be carried with the steam to some point where there is opportunity for it to separate."

An engineering acquaintance of ours whose regular practice is to drain the pipes toward the engine was recently consulted regarding a main of considerable length which was to serve a steam hammer to be used at intervals. In this he reversed his usual practice and drained the pipe toward the boiler, his argument being that when

the hammer was at work the water would go with the steam, regardless of the inclination of the pipe, but that, with the hammer standing still, the plan advised would cause the condensed water to drain back to the boiler, while with the opposite plan the pipe would become filled with water which would then have to be gotten rid of. —Ed.]

Education of Apprentices.

Editor American Machinist:

I have read with a great deal of interest Prof. Higgins' very able paper on "Education of Machinists, Foremen and Mechanical Engineers," published in the issues of December 27 and January 4. His paper treats of the boys who will be growing up at the time when his proposed "half-time school" shall be started, and for these boys it will be one of the grandest openings ever offered.

But what about the boys who are leaving the grammar schools of to-day and entering the machine shops as apprentices? What is being done to give these boys the technical as well as the practical side of their trades?

In the majority of machine shops an apprentice is considered rather an expensive investment for the first year or eighteen months, and therefore the managers naturally expect to make up what they have lost in the first half of his time by keeping him on work in the last half which he is thoroughly familiar with, and of course can turn out much cheaper than a journeyman. They do not, as a rule, consider that they are called upon to teach him anything but the practical side. This, of course, is not true in all shops. Some managers are beginning to be of the same opinion as Prof. Higgins, and have started on ideas which have seemed best to them.

I understand that the firm of R. Hoe & Co., of New York, make it one of the rules of their contracts with apprentices that they shall attend the company's night school three nights in the week. The Brown & Sharpe Manufacturing Company, of Providence, R. I., have a very good way of helping their apprentices. They are allowed one hour once a fortnight to discuss mechanical subjects by themselves. That is, they quit work at 5 o'clock on this day and assemble in the reading room, where they are either addressed by some of the mechanical engineers or foremen of the company upon some subject bearing upon their work, or else some member will be ready with information which he has been requested to look up beforehand. In addition to this hour, which is generally very profitably spent, the company employs a superintendent of apprentices, who is an able mechanic, and whose sole duty is to look after the apprentices. This firm employs about sixty apprentices, so that this superintendent makes the rounds among them about once a day. He instructs them as to the best way to do their work, answers any questions on mechanical matters, and acts as a go-between between the apprentices and the foremen, settling any little grievances, etc. It is his place to see that the boys are given as much variety of work as possible and also fair treatment.

But all boys are not fortunate enough to serve their time in shops like these I have cited, and it is for these that this paper is intended.

In most large cities to-day there are free evening schools which teach the ordinary studies. If a boy has been obliged to go to work before completing his common school education, I should advise him by all means to enter one of these schools.

If the boy has a taste for drawing, or wishes to understand it, so that he can intelligently read the drawings which he is working from in the shop, then he should go to some good evening drawing school. There is generally at least one of these schools in most cities, and the cost of tuition is not very much. There are a large number of boys in the shop to-day, and for that matter a number of journeymen, who are really very capable, but they do not get ahead, because they don't have anyone to tell them of a really good way. When I was serving my time I went to an evening drawing school, and there I obtained enough knowledge of drawing to start me in the drawing room. Any boy can do the same. After I had been in the drawing room for some time, a friend spoke to me about studying the theoretical or technical side of engineering. I could not afford to go to college, so he advised me to take a course of study by correspondence. I did not believe it could be done, but I joined the International Correspondence Schools of Scranton, Pa., and I have been very much surprised at what they have been able to teach. Reference has been made to these schools in these columns, and anyone may see them advertised in this and other papers; but it seems to me that the average boy and man are not so apt to pay attention to an advertisement as they are to what they see in the reading columns. Therefore I propose to describe the very good work which these schools are performing.

All that is essential to join them is that a man must know how to read and write in the English language. The first subject taught is arithmetic, and this is commenced at the beginning with ordinary numbers. Then come addition, subtraction, multiplication, division, etc., proceeding step by step until cube root, ratio and proportion are reached. After arithmetic comes algebra, which also starts at the beginning and takes the student very gradually through it. In the mechanical enginering course, after algebra comes higher mathematical and engineering work. Each study leads up to the next one, and therefore makes it easier.

These schools are of great advantage in that, besides what they teach, they keep employers informed as to the progress made by the students, and they also recommend their students to very good positions. If a young man cannot get an engineering education in a university, I know of no better way than to take a course of study in some good correspondence school.

I might add that the price of instruction in these schools is so very low that even a first-year apprentice can afford to take a course if he desires.

Providence, R. I. H. DANFORTH.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 20.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

D'ftsmen's novelties. D.J.Kelsey,N.Naven,Ct.

Rawhide, fibre and hard rubber gears. The Arthur Co. (See page 8.)

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies & Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

Wanted—Good second-hand 20 or 30 in. lathe and small boring mill. Correspond with Northwestern Supply Co., Duluth, Minn.

Any shop prepared to build a small link-motion model in lots of 100 or more should write to Box 140, AMERICAN MACHINIST.

For Sale—Two geared Ferracute presses, 62 in. between uprights; little used, and in good condition. Address W. H. Mullins, Salem, Ohio.

Threads and gears; easy rules to cut any thread possible to be cut in the lathe, without algebra, sent to any address for 25c. by G. W. Dixon, Spring Lake, Mich.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wanted—Tenders for the construction of machines in quantity; machines weigh about 6,600 lbs., and shop should have a planer 42 in. wide and a 30 in. lathe, and must be fitted for general machine work, including such fine work as is required for weighing devices; also would like to hear of a shop fitted for doing such work that might be leased or purchased. Box 161, AMER. MACH.

The patents, patterns and special tools of a new high-grade special machine lately patented in the United States and Europe will be sold out shortly; price $25,000; 13 of these machines have been sold within 15 months and give entire satisfaction; the gross profits on same amount to $10,486; this is a splendid addition to the business of any large machine concern, as there is a steady demand for these machines. For investigation and details address Box 160, AMERICAN MACHINIST.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Draftsman (mechanical) wants position. Box 162, AMERICAN MACHINIST.

Foremanship of iron foundry, by foreman, experienced on engine and general jobbing work. Box 135, AMERICAN MACHINIST.

Position as chief draftsman or superintendent; slide valve and Corliss engines, air compressors, etc. Box 168, AMER. MACH.

Wanted—Position, by machinist, toolbuilder, to go to Paris Exposition; not afraid of work. Box 166, AMERICAN MACHINIST.

Mechanical engineer and designer, 6 years' experience; mill work preferred; cement mill experience. Box 169, AMERICAN MACHINIST.

Technical graduate and draftsman of 1½ years' experience desires to change; best of references. Box 163, AMERICAN MACHINIST.

Manager or general superintendent, energetic and practical; familiar with every position along the line of practice in foundries, machine shops, etc. Box 167, AMER. MACH.

Machinist of 20 years experience with machinery and making of tools would accept position as foreman in machine shop. Address J. S., Room 906, Real Estate Exchange Bldg., Brooklyn, N. Y.

A successful mechanic with a good business and legal knowledge wishes to make a change; experienced in the position of chief engineer, purchasing agent and superintendent; reference A1. Box 164, AM. MACH.

Position wanted as head foreman, by thorough mechanic, used to general machinery, dynamos, tools; tools designed for close interchangeable work; can handle men to best advantage. Address Box 783, Orange, N. J.

Draftsman, experienced in general machinery, mill work, machine tools and some automatic machinery, desires position; am technical graduate; 6 years' drawing room, 5 years' shop experience. Address Box 165, AMERICAN MACHINIST.

Toolmaker of ability and long experience on automatic screw machinery and tools will shortly be open for engagement; expert on caming labor-saving tools for anything made in rod stock; accustomed to handling men, and a cost reducer. Box 1811, Bridgeport, Conn.

Help Wanted.

Wanted—Young man having had some experience in mechanical drawing. Box 147, AMERICAN MACHINIST.

MECHANICAL ENGINEERS AND DRAFTSMEN

WANTED.

Capable and Experienced Men should become acquainted with us.

Our business is to secure good positions for first-class mechanical, civil and electrical engineers and draftsmen.

WRITE US, stating your experience briefly, and we will send you the necessary papers to be filled out in full.

The Engineering Agency,

1605 Monadnock Block, CHICAGO, U.S.A.

To Manufacturers of Boring and Turning Mills, Slotting Machines, Keyseating Machines, Heavy Planing Machines, Gear Cutting Machines, Universal Grinding Machines, Pneumatic Tools, Air Hoists, etc., etc.

An English house of the highest standing and having branches in all the leading centers of industry in Great Britain, wishes to negotiate with Builders of the above Machines for exclusive Agency for Great Britain.

ALFRED HERBERT, Ltd.,
Coventry, England.

MACHINIST WANTED—One perfectly familiar with the setting up and repairing of Scott and Potter Litho. Presses. Reference required. Good Place for good man. When writing, state salary expected.

Box 155, American Machinist.

Wanted—Young men to learn engraving by mail; send for circular. Home Engraving School, Box 1,171, Springfield, Mass.

Wanted—First-class toolmaker; state where last employed, age, experience and wages expected. Box 144, AMERICAN MACHINIST.

Wanted—Foreman for brass-finishing shop, on valves, plugs and special brass work; none but experienced man need apply. Box 145, AMERICAN MACHINIST.

Wanted—A draftsman with experience in design of machine tools; state age, experience and salary expected. Address P. O. Box 1,042, Philadelphia.

Foreman molder wanted on good machine castings in green and dry sand, to compete with the market in quality and price. N. B., 703 Beard Building, New York.

An engineering concern about to build extensive new works wants draftsman to design same; experience in this line essential. Address Box 157, AMERICAN MACHINIST.

Wanted—Reliable accurate draftsman experienced in machine-tool and jig work; state qualifications, references and wages expected. The Bickford Drill & Tool Co., Cincinnati, O.

Wanted—2 or 3 first-class general machinists on light tool making, small auto. machinery, jigs, fixtures, etc.; state age, experience and wages expected. Address Box 156, AMERICAN MACHINIST.

Wanted—Foreman for machine shop, not over 35; active, energetic man with experience with machine tools; give record, reference and salary desired. Address Box 159, AMERICAN MACHINIST.

Wanted—A stenographer in this office, used to mechanical terms; man having experience in machine-tool shop preferred. Address AMERICAN MACHINIST, Business Office, 218 William st., New York City.

Wanted—First-class mechanical engineer and draftsman; one who has had large experience in electric traveling cranes preferred; good salary and permanent position. Box 149, AMERICAN MACHINIST.

Wanted—3 or 4 good machinists and 1 sheet iron worker for regular work in machine shop; good pay and steady work to competent men. State age and experience to Kenney & Co., Scottdale, Pa.

Modern brassworker in globe valves; temperate; must give reference for ability and character; state wages desired and whether able to control men; good position to right man. "Valve," AMERICAN MACHINIST.

Machinist wanted; one perfectly familiar with the setting up and repairing of Scott and Potter litho presses; reference required; good place for good man; when writing, state salary expected. Box 155, AMER. MACHINIST.

Wanted—An expert mechanical draftsman on electric traveling cranes, also one experienced on Corliss engines and blower work; will pay good price to right man. Philadelphia Engineering Works, Ltd., Mifflin and Meadow sts., Philadelphia, Pa.

We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite application from draftsmen, pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

Wanted—Competent draftsman with experience on machine tools and hydraulic machinery; young man, technical graduate preferred; give experience, reference and salary desired; good opening for right man. Address Box 158, AMERICAN MACHINIST.

Wanted—First-class machinists, familiar with floor work in erecting heavy pumping engines, hoisting engines and air compressors; good wages; steady work; modern equipped shop. Apply in person, Fraser & Chalmers, 12th st. and Washtenaw ave., Chicago, Ill.

Wanted, Immediately—A draftsman experienced in complete and detail drawing on machine-tool work; one who has good shop experience; state experience, references, character, age, habits, married or single, wages expected. Address Landis Tool Co., Waynesboro, Pa.

Wanted—By a machine shop in Central Ohio, a hustling, first-class superintendent, full of good ideas for simplifying the manufacture of specially designed light and heavy work; must be able to handle about 80 men successfully; sober, industrious, truthful, age 32 to 48, with large experience; good wages paid right man; state fully your capabilities and reasons for quitting your present position; none but competent persons need apply; answers made only to those thought to fill the requirements; all correspondence treated confidentially. Address "K. L.," care AMERICAN MACHINIST.

Legal Notes—Injury Due to Defective Electrical Insulation—Agent's Responsibility—Giving Notice of Defects.

The Rhode Island Supreme Court recently rendered a decision in favor of James Moran in his suit against the Corliss Steam Engine Company. The suit was brought to recover damages for personal injuries received by coming in contact with a defectively insulated crane operated by an electric motor, and resulted from the alleged negligence of the Corliss Steam Engine Company. The testimony showed that the crane at which the accident occurred was defectively constructed, either in that there was a metallic connection between the hauling chain and the motor, or that the insulation between them was not sufficient to prevent a leakage of electricity from the motor to the chain, and that though the leakage of electricity was probably insufficient to be dangerous, with no greater current than that designed to be used to operate the crane, yet it was liable to become dangerous from the presence of a more powerful current. At the time of the accident the wind was blowing at the rate of forty miles an hour, with puffs at the rate of sixty miles. In the Court's opinion the jury would have been warranted in finding that the accident was due to the contact, outside of the defendant's premises, between the wire supplying electricity to the motor of the crane and some more heavily charged wire, whereby, by reason of defective insulation, possibly occasioned by the rubbing together of the wires, an unusually strong current was transmitted over the wire to the crane, and thence, by reason of the faulty construction of the crane, to the hauling chain.

The Court, in deciding the case for the plaintiff, said, "In view of the subtle and dangerous nature of electricity, the defendant making use of it was bound to exercise a very high degree of care for the protection of its employees against injury from such use. The accidental crossing or contact of wires caused by their sagging or breaking, or by high winds and other causes, and the consequent charging of the wires carrying the light current with a dangerous current from a more heavily charged wire, is, in our opinion, of sufficiently frequent occurrence to have suggested to the defendant the liability of accident from that cause, and to have required it to take precautions against injury to its employees thereby." (45 L. R. A. 267.)

The Port Huron Engine & Thresher Company brought suit against John W. Smith and others upon a promissory note executed by the defendants to the Upton Manufacturing Company in part payment for a threshing outfit, consisting of traction engine, separator, etc., purchased from this Upton Company, and by the Upton Company assigned, before matur-

ity, to the Port Huron Engine & Thresher Company. The contract of sale contained the following clause: "Conditioned that if, upon trial, the purchasers are unable to make it operate well, notice is to be given to the party selling it and to the Upton Manufacturing Company, at Port Huron, Mich., and time given to get to it and put it in order. If they are not able to make it perform as above, the purchasers rendering necessary assistance, and the fault is in the machine, it is to be taken back, and the payment refunded, or the defective part remedied. But if the purchasers fail to make it perform, through improper management or want of skill, and call on the manufacturers or their representatives, then the purchasers are to pay all expenses incurred. This warranty shall be considered fully satisfied unless the purchasers shall give us and our agents, of whom they purchased said machinery, written notice within ten days after trial, of its failure to fulfill the terms of the warranty." The jury found, and there was evidence to prove, that, when the engine was in the hands of an experienced engineer, it did not develop full 12 horse-power; that the machine was never in good running order; that it would not furnish the necessary power for threshing on account of its defective construction, and that the defendants had within ten days after a trial and the failure of the machine to operate satisfactorily, given *verbal* notice to the agent from whom the machine was purchased, and that this agent attempted to make the machine run properly, but had failed to do so. The jury rendered a verdict for the defendants, and the plaintiffs appealed to the Appellate Court of Indiana. The Appellate Court, in affirming the judgment in favor of the defendants, held that although there was no evidence that defendants had given *written* notice to the Upton Manufacturing Company, the evidence that notice had been given to the agent, and that he had acted upon such notice for his principal, was sufficient to bind the Upton Company, since it was a matter within the scope of the agency, and in such case notice to the agent is notice to the principal. (52 N. E. 106.)

A somewhat similar case is that of Gaar, Scott & Co., vs. Hill, decided by the Kentucky Court of Appeals. Gaar, Scott & Co. brought an action against C. M. Hill on a promissory note which was given to the plaintiff by Hill in payment for a machine. Hill defeated the plaintiffs' recovery on the note to the extent of $110 upon the ground that the "straw stacker" for which the note was in part executed, was not what it was represented to be. The plaintiff claimed that the condition in the contract of sale, which provided that Hill should notify them in writing, and by registered letter, within ten days after the first use of the machine, of any failure of the stacker to do its work properly, had

(*Continued on page 45.*)

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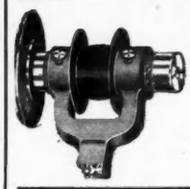

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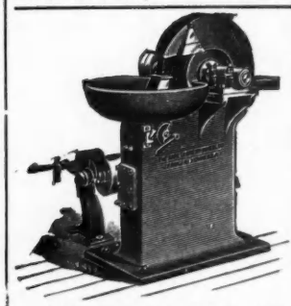

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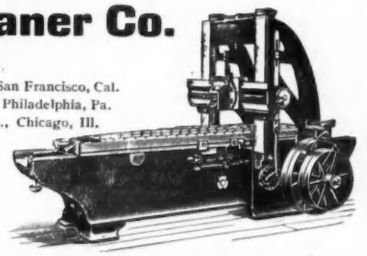

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Yours drop-forgingly,

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Feb. 1, 1900.

(*Continued from page 44.*)

not been performed by Hill. In affirming the judgment in favor of the defendant, the Court said, "We think this stipulation as to the time of such notice can have no reference to such defects as were not discovered, because not developed, on the first use of the machine. As to such, the notice must be given within a reasonable time after discovery and development." (49 S. W. 202.)

W. MARSTON SEABURY.

New York.

The Prentiss Tool & Supply Company, of New York, are the selling agents for the "Acme" screw machine, which we illustrated in our issue of January 18, and we were indebted to them for assistance in gathering material for the descriptive article.

At a recent meeting of the Committee on Black Smoke, in Glasgow, the sanitary inspector submitted diagrams showing the results of the mechanical improvements for the prevention of black smoke adopted by certain firms. During the month of November 74 inspections were made of boilers and furnaces, and 135 observations were taken of chimneys; 18 warning notices were issued to defaulters, giving them one month wherein to effect the necessary improvements. During the month 77 prosecutions were taken against offenders and seven convictions obtained. Since the work was taken over by the sanitary department 17 firms have made alterations and improvements in their plant, five are burning better fuel than formerly, and six have discharged incompetent firemen.—"The Engineer."

New Catalogs.

The Ajax Manufacturing Company, of Cleveland, Ohio, has just issued its 1900 catalog, which contains descriptions and illustrations of new machines as well as their former line of machinery. The machines treated include bolt headers and upsetters, bolt-threading machines, rivet-making machines, etc. The catalog contains 79 pages, is bound in cloth, and measures 4½x7 inches.

The Taper-Sleeve Pulley Works, Erie, Pa., send us catalog which is devoted to the illustration and description of their solid web hardwood dynamo pulleys, which are particularly adapted for heavy strains and high-speed belts. The method by which these pulleys are made is described. The catalog contains a number of testimonial letters from users of the pulleys, also a price list.

Columbus Machine Company, of Columbus, Ohio, has gotten out a special edition of its catalog of gas and gasoline engines, and copy of which they have sent us. The catalog contains descriptions and illustrations of gas engines of various kinds and adapted to various services, such as electric lighting, pumping, running grain elevators, etc. These engines are fully described, their construction and method of operation being gone into with considerable care. The catalog contains some interesting comparisons between the cost of running a gasoline and a steam engine.

We have received from the Baron de Hirsch Trade School, No. 222 East Sixty-fourth street, New York, a copy of the 1900 catalog. The object of the institution is set forth, which, briefly, is to fit young men in as short a time as possible to enter one of the mechanical trades as a means of livelihood. The catalog also contains information regarding requirements for admission, system of instruction, etc. All instruction is free. They also send us a copy of the tenth annual report of the superintendent, which contains a number of tables showing progress of the members of the various classes. Both the annual report and catalog show interior views of the various departments, and to those interested in industrial education the publications ought to be of interest.

Manufacturers.

The Lucas Machine Tool Company, of Cleveland, Ohio, has just been formed, and will engage in the designing and building of machine tools and special machinery.

While in Phillipsburg, Pa., recently Thomas A. Edison said the big cement plant about to be erected in that county would be quite large and that it would be equipped with modern machinery.

The Covert Manufacturing Company, Watervliet, N. Y., has been incorporated with a capital of $50,000. The directors are James C. Covert, Ellen E. Covert and Fred. W. Covert.

An electric lighting plant is to be erected at Woodbury, N. J., by the Woodbury Electric Light Company. This will be devoted entirely to incandescent lighting and will be equipped with power apparatus, machinery, etc.

In the construction of a new and completely equipped electric lighting plant at Boyertown, Pa., $15,000 is to be spent. Bonds are to be issued for the project and bids will provide for the furnishing of necessary power apparatus.

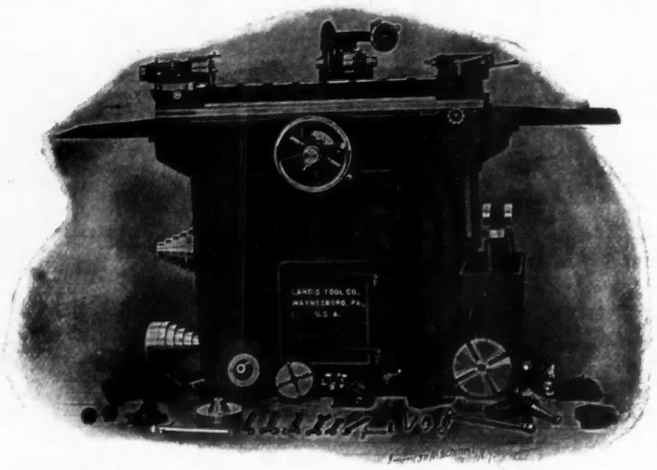
Contractor William R. Dougherty recently signed the contract to build the four-story brick and iron factory extension, 174½ by 70 feet, to the Fern Rock Woolen Mills, Wishart and Amber streets, Philadelphia, at a cost of about $40,000.

The Shaw Electric Crane Company, Muskegon, Mich., will erect a new pattern shop and storehouse adjoining their plant. The pattern shop will be constructed of wood, and be built by the company; the storehouse will be of brick, and built on contract.

R. E. Ross, of Chester, Pa., is interested in the formation of a stock company at that place which will be composed of Chester and Philadelphia parties, with the idea of erecting and establishing a large steel plant near Marcus Hook, Pa. A site at the latter place is under consideration now.

A planing mill, measuring 85x83 feet, with a boiler house, 20x20 feet, and a large storage shed, will be erected for Franklin W. Smith at the south side of Marsden street, Philadelphia, Pa., between Thirtieth street and the Schuylkill river. The mill itself will be of brick and iron, with a slag roofing, one story high.

The Braddock (Pa.) Machine & Manufacturing Company, recently organized by Mr. Harry Stanyon and others, for the purpose of manufacturing a line of machine tools, air compressors, etc., has awarded several contracts for the erection of its new plant at Braddock. The building will be constructed by the Pittsburgh Bridge Company, and will consist of a main building, 60x300 feet; a second shop, 80x200 feet, and the third, 30x200 feet.



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